

Biology - 9700

■ 32 Questions

Topics Covered :

- ✓ 7.1 - Structure of transport tissues
- ✓ 1.2 - Cells as the basic units of living organisms
- ✓ 2.2 - Carbohydrates and lipids
- ✓ 5.1 - Replication and division of nuclei and cells
- ✓ 1.1 - The microscope in cell studies
- ✓ 4.2 - Movement into and out of cells
- ✓ 10.1 - Infectious diseases
- ✓ 2.4 - Water
- + 12 more topics...

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Question No 1 - (9700_m24_22_3)

Subsection Topics: (a) : 7.1 - Structure of transport tissues | (b) : 1.2 - Cells as the basic units of living organisms | (c) : 2.2 - Carbohydrates and lipids

(a) Fig. 3.1 is a photomicrograph showing part of a transverse section through the root of an iris, *Iris germanica*. Irises are herbaceous monocotyledons. These plants have the same transport tissues as herbaceous dicotyledons, but the transport tissues are distributed differently. In monocotyledons, the central tissue in the root is parenchyma (packing tissue).

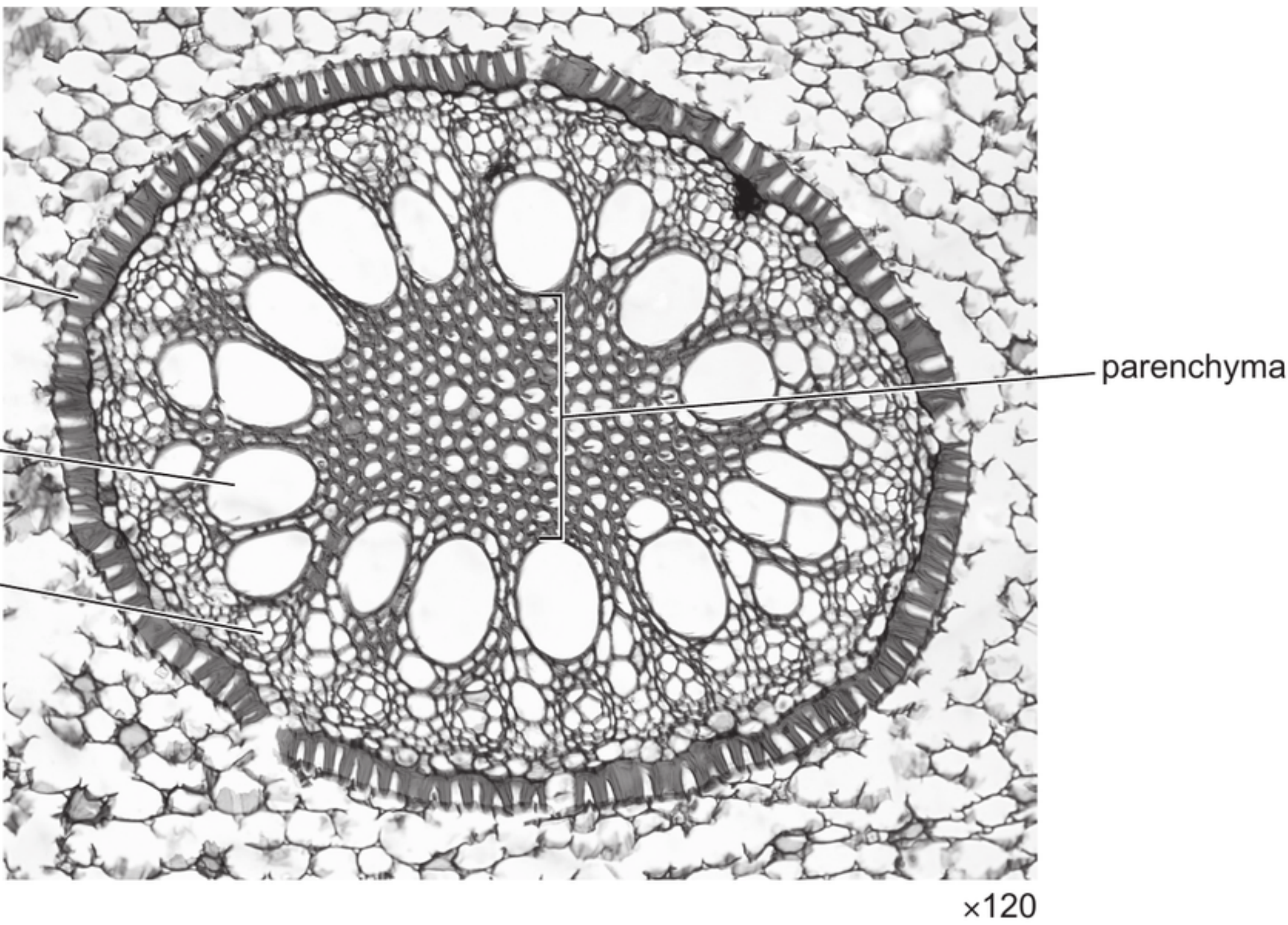
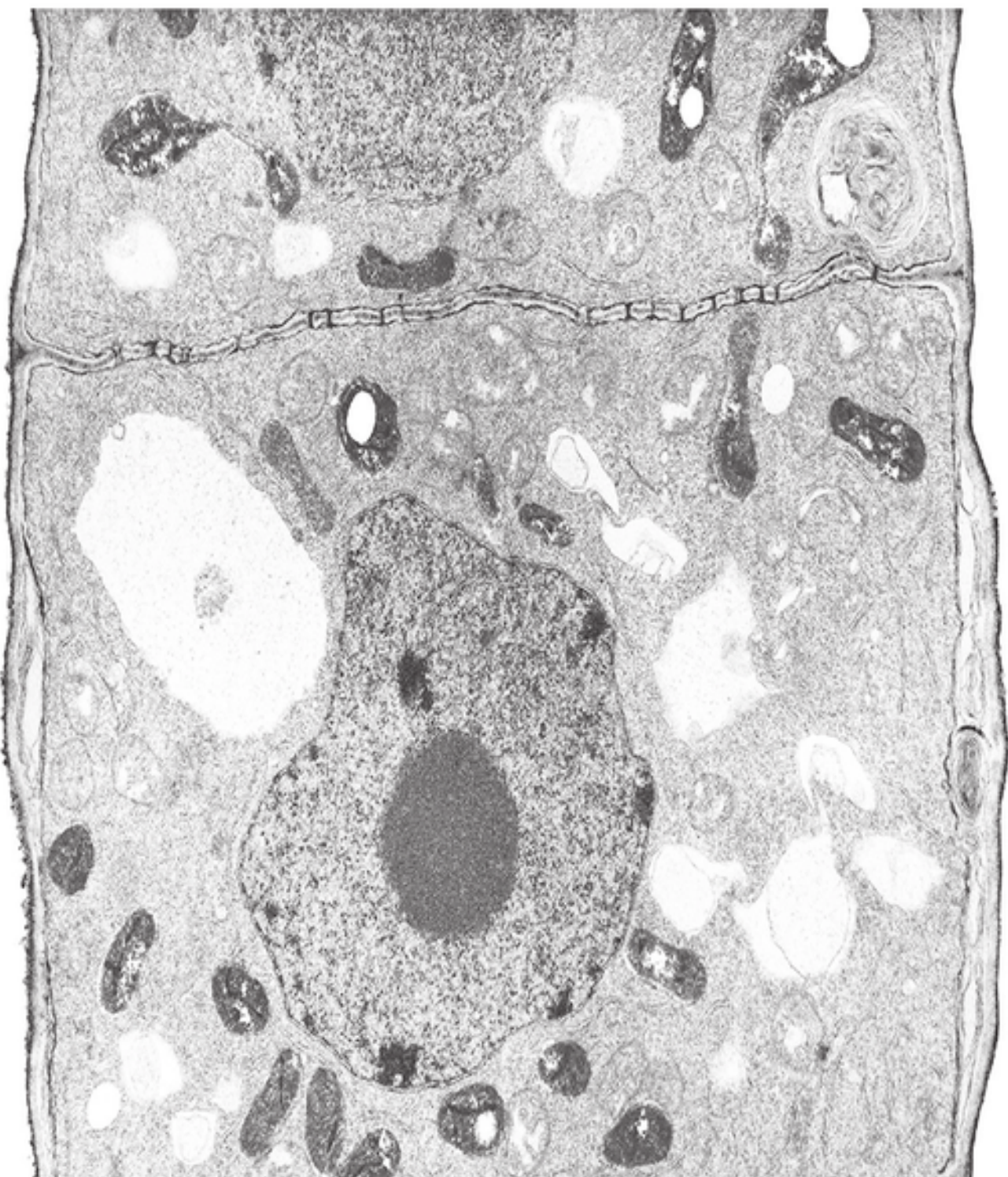


Fig. 3.1

- (i) Cells **R**, **S** and **T** in Fig. 3.1 are found in different tissues.
- Name the tissues in which the cells labelled **R**, **S** and **T** are found.
- tissue in which cell **R** is found
- tissue in which cell **S** is found
- tissue in which cell **T** is found [3]
- (ii) Outline the role of the tissue in which cell **R** is found in Fig. 3.1.
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- [2]
- (iii) State an example of an organic compound that is translocated in the root of an iris.
- [1]
- (b) The electron micrograph in Fig. 3.2 shows a section through some root cells in an onion, *Allium cepa*.



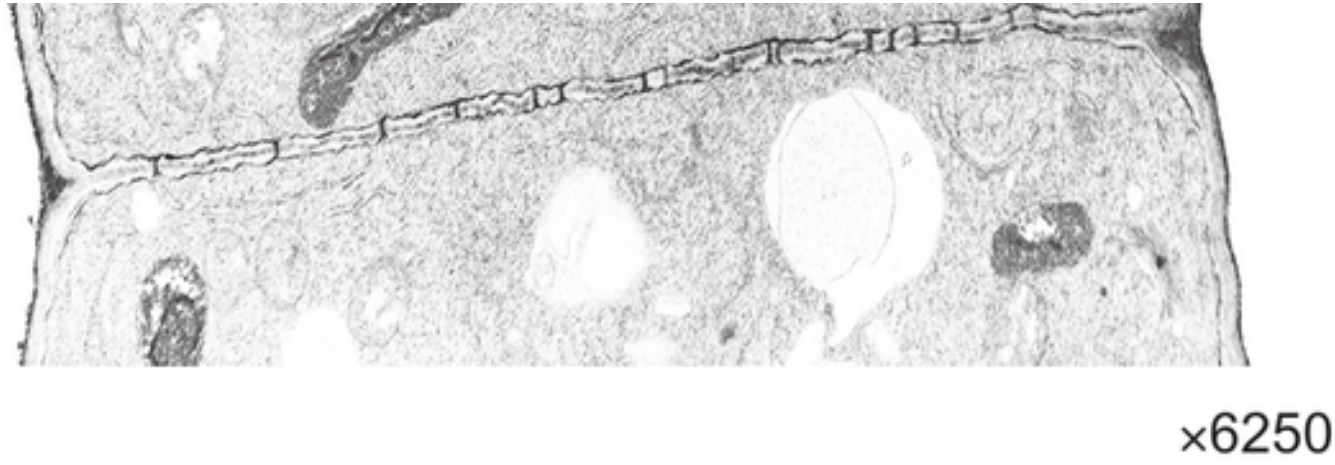


Fig. 3.2

On Fig. 3.2, draw a label line and label it with the letter **P** to identify **one** plasmodesma. [1]

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(c) Table 3.1 contains information about four polysaccharides found in animals or plants.
Complete Table 3.1 by filling in the missing information.

Table 3.1

polysaccharide	monomer	glycosidic bond(s)	function
amylopectin	α -glucose	1,4 and 1,6	energy storage in plants
amylose		1,4	energy storage in plants
cellulose	β -glucose		structural role in plant cell walls
glycogen	α -glucose	1,4 and 1,6	

[3]

Question No 2 - (9700_m25_22_1)

Subsection Topics: (a) : 1.1 - The microscope in cell studies | (b) : 1.1 - The microscope in cell studies |
(c) : 7.1 - Structure of transport tissues | (d) : 4.2 - Movement into and out of cells | (e) : 4.2 - Movement
into and out of cells | (f) :

Smilax china is a herbaceous plant.

Fig. 1.1 shows part of a transverse section of a root of *S. china* with root hair cells visible.

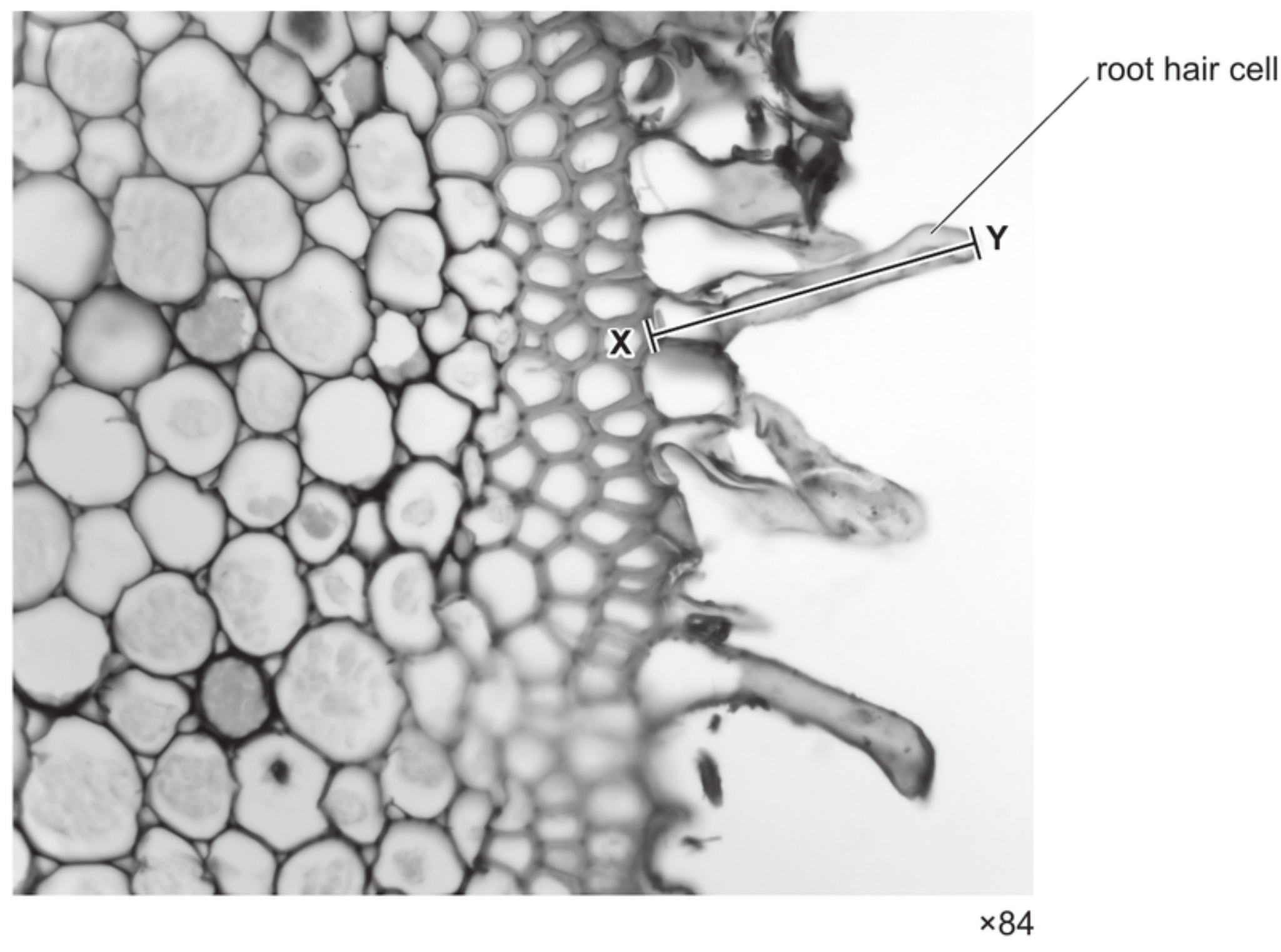


Fig. 1.1

(a) Name the type of microscope that has been used to obtain the image in Fig. 1.1.
..... [1]

(b) Calculate the **actual** length, in micrometres (μm), of the root hair cell labelled in Fig. 1.1. Use the **image** length of the root hair cell along line **X–Y** in your calculation.

actual length = μm [1]

(c) Root hairs are important adaptations of root hair cells for the uptake of water.
Explain **one** way in which root hairs adapt root hair cells for the uptake of water.
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..... [1]

(d) Mineral ions are taken up by root hair cells.

Table 1.1 shows the concentrations of sodium ions (Na^+) and potassium ions (K^+) inside the root hair cells of a plant root and in the soil solution surrounding the root.

Table 1.1

concentration of Na^+ / g dm^{-3}		concentration of K^+ / g dm^{-3}	
root hair cell	soil solution	root hair cell	soil solution
0.35	3.34	5.46	0.16

With reference to Table 1.1:

- suggest the mechanisms involved in the transport of Na^+ and K^+ from the soil solution into the root hair cells
- state the reasons for your suggestions.

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(e) The region between the outer layer of a root and the endodermis is known as the cortex. Table 1.2 shows the water potential of two adjacent cells, **A** and **B**, in the cortex of a root.

Table 1.2

water potential / kPa	
cortex cell A	cortex cell B
–120	–350

With reference to Table 1.2, explain the direction of water movement between cell **A** and cell **B**.

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..... [2]

(f) Some types of soil are made of small negatively charged clay particles that attract and bind to positive ions such as iron ions (Fe^{2+}).

Fe^{2+} that is bound to clay particles **cannot** be absorbed by root hair cells. This reduces the concentration of free Fe^{2+} that is available in soil solution for absorption.

Some plants that grow in soils containing a high proportion of clay particles are able to increase the concentration of free Fe^{2+} in the soil solution for absorption. In these plants, the carbon dioxide released by the respiration of root hair cells reacts with water in the soil solution, which changes the pH of the soil solution. This affects the binding of positively charged ions, such as Fe^{2+} , to clay particles.

Fig. 1.2 shows the results of one investigation into the effect of pH on the concentration of free Fe^{2+} that is available in soil solution for absorption by root hair cells. The soil sample analysed in this investigation was from a soil that contained a high proportion of clay particles.

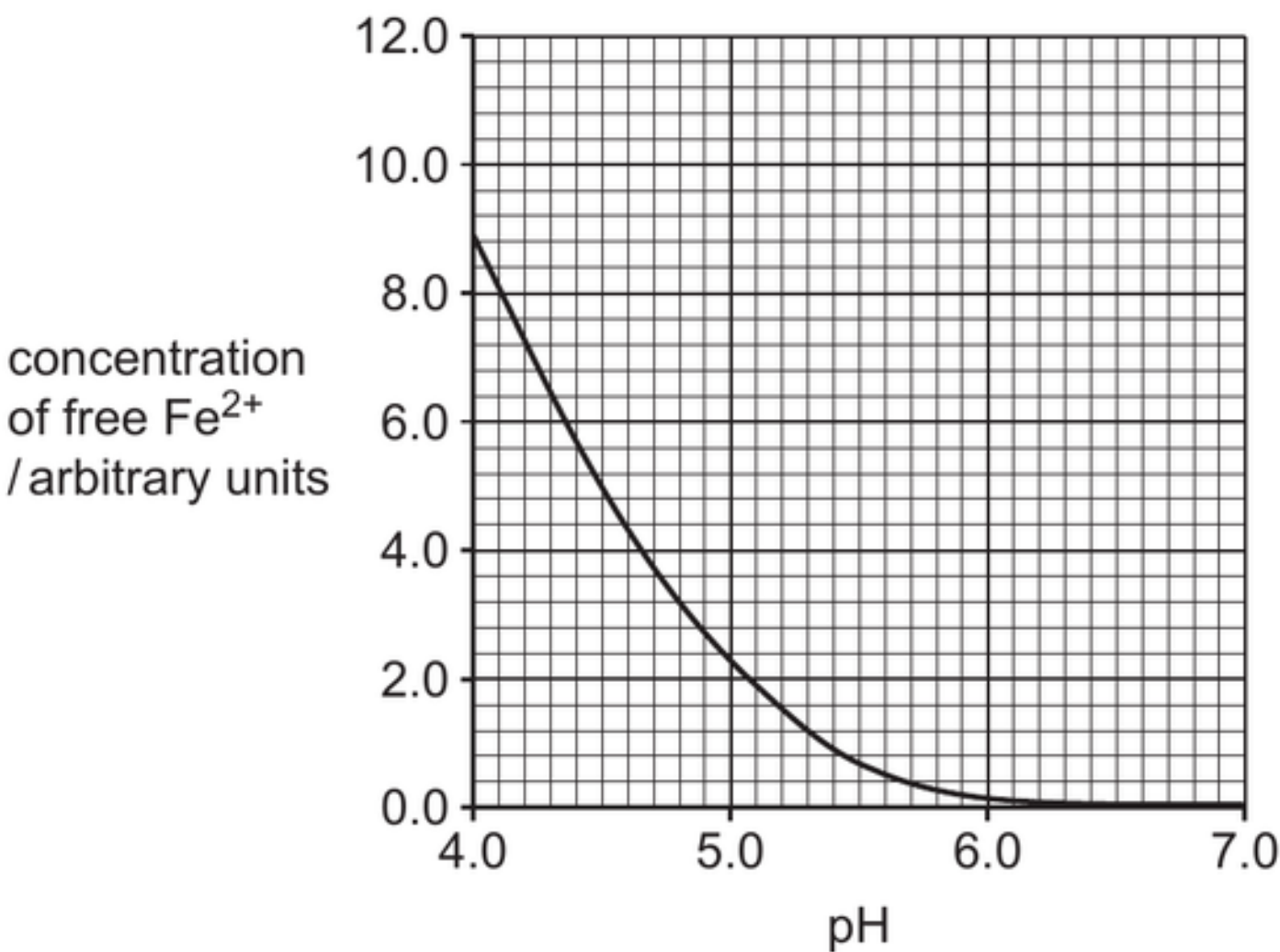


Fig. 1.2

- (i) With reference to Fig. 1.2, suggest **and** explain how the carbon dioxide released by the respiration of root hair cells can increase the concentration of free Fe^{2+} for absorption by root hair cells.

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- (ii) Dissolved Fe^{2+} is transported across the tissues of the root to the xylem.

When the amount of dissolved Fe^{2+} absorbed by root hair cells is greater than the amount that is needed by the plant, not all of the Fe^{2+} that is absorbed is transported to the xylem.

Suggest how the endodermis can reduce the amount of Fe^{2+} reaching the xylem.

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[3]

Question No 3 - (9700_m24_22_5)

Subsection Topics: (a) : 1.1 - The microscope in cell studies, 10.1 - Infectious diseases | (b) : 1.2 - Cells as the basic units of living organisms

The pathogen that causes cholera is a prokaryote.

(a) Fig. 5.1 shows an electron micrograph of the pathogen that causes cholera.

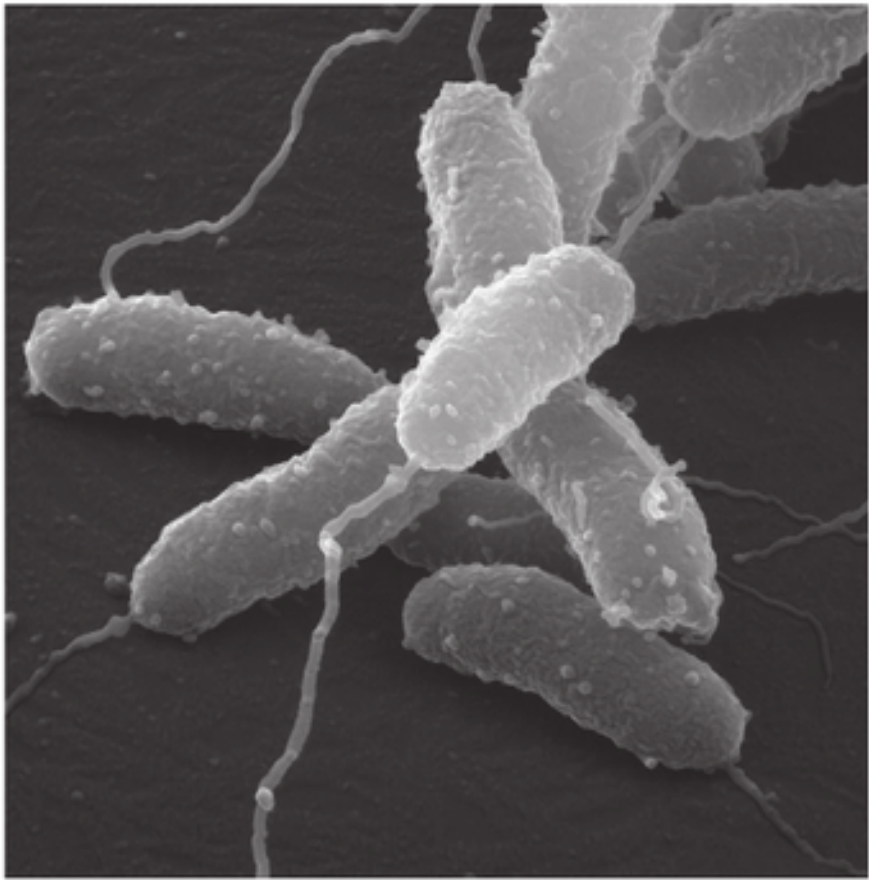


Fig. 5.1

- (i) Name the type of electron microscope used to produce the image shown in Fig. 5.1.
- [1]
- (ii) Name the species of prokaryote that causes cholera.
- [1]
- (b) The passage contains a description of the main features of prokaryotic cells. There is **one** factual error in the passage.

Prokaryotic cells are unicellular and generally between 1µm and 5µm in diameter. Prokaryotes do **not** have organelles surrounded by double membranes. They do have cell surface membranes, 70S ribosomes and a cellulose cell wall. The DNA of a prokaryotic cell is circular and is found free in the cytoplasm rather than enclosed in a nuclear envelope.

Identify **and** correct the factual error in the passage.

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..... [1]

Question No 4 - (9700_s24_21_5)

Subsection Topics: (a) : 7.2 - Transport mechanisms | (b) : 7.2 - Transport mechanisms

The pressure of water vapour inside and outside leaves can be measured. The difference between these pressures is known as the leaf vapour pressure deficit (LVPD).

LVPD is one of the factors that influences the rate of transpiration.

Scientists measured the effect of changing the LVPD on the rate of transpiration in several species of flowering plant that live in a variety of different habitats. Two of these species were:

- *Nerium oleander*, a species that is adapted to grow in hot, dry conditions
- *Helianthus annuus*, a species that is not adapted for survival in hot, dry conditions.

Fig. 5.1 shows the effect of increasing the LVPD on the transpiration rates of the two species.

All other factors were kept constant.

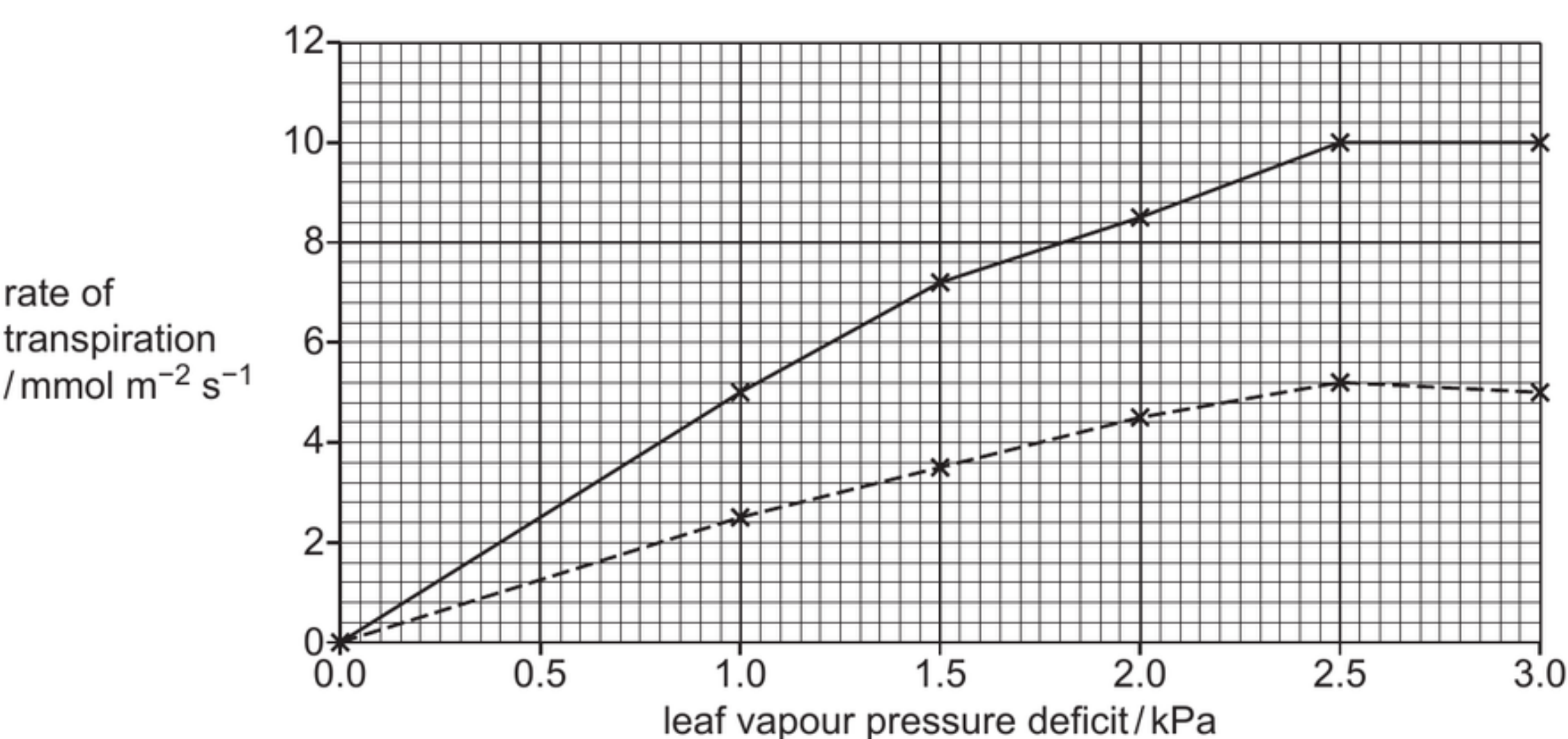
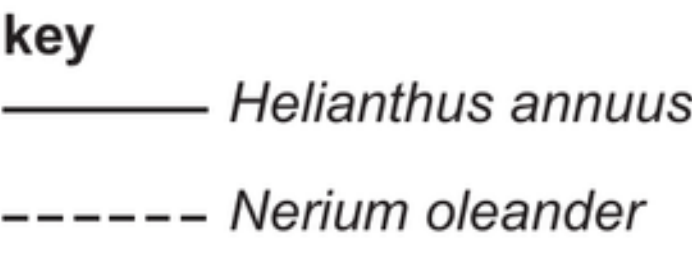


Fig. 5.1

(a) Compare the results of the two species shown in Fig. 5.1.

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..... [3]

(b) Fig. 5.2 shows part of a plant of *N. oleander*.



Fig. 5.2

Fig. 5.3 shows a cross-section of part of an oleander leaf.

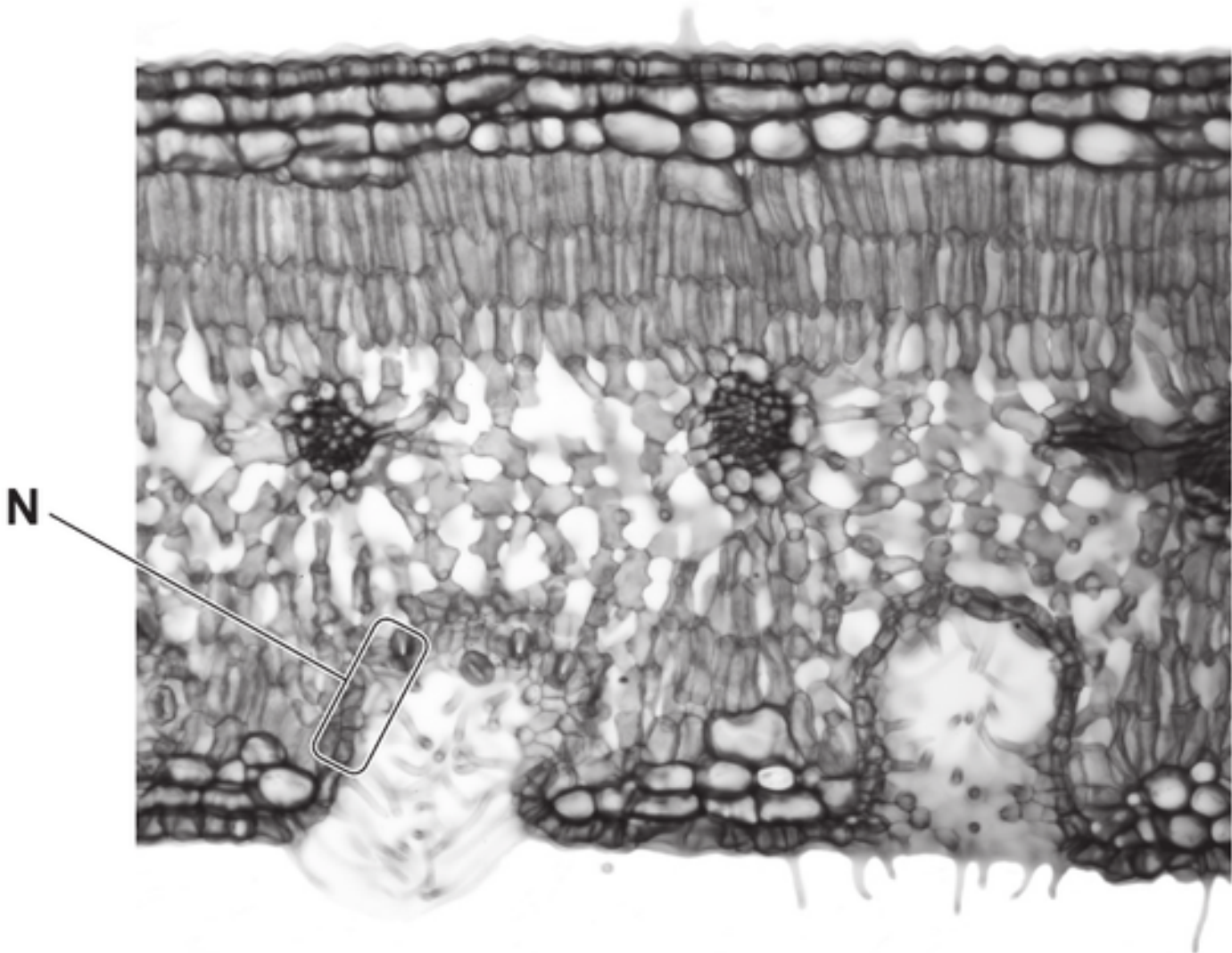


Fig. 5.3

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Fig. 5.4 is a drawing of a high-power view of region **N** on Fig. 5.3.

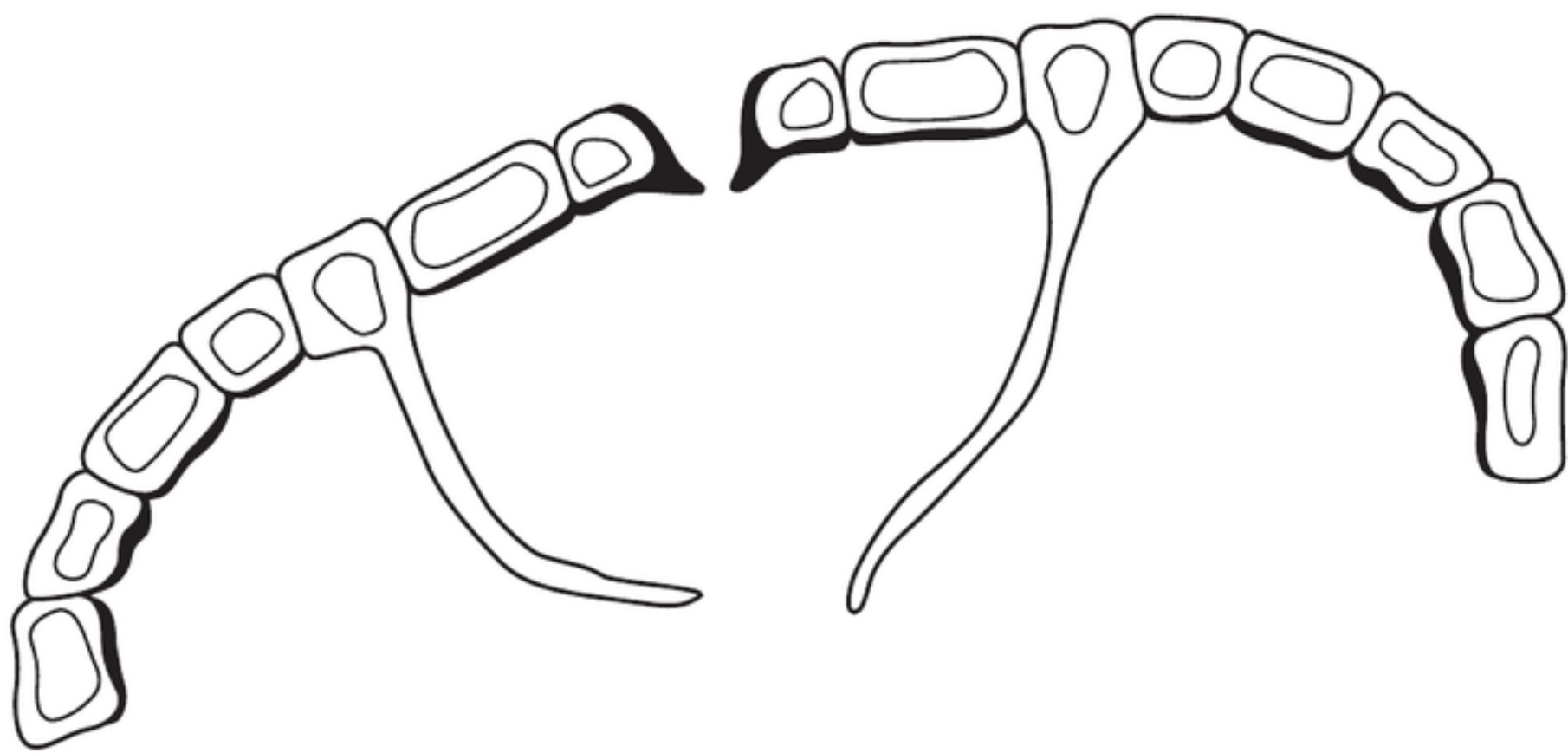


Fig. 5.4

State **and** explain **two** adaptations shown by the leaves of *N. oleander* that are visible in Fig. 5.3 and Fig. 5.4.

one adaptation visible in Fig. 5.3

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explanation

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one adaptation visible in Fig. 5.4

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explanation

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Question No 5 - (9700_s24_22_4)

Subsection Topics: (c) : 4.2 - Movement into and out of cells | (e) : 7.2 - Transport mechanisms | (a) : 2.2 - Carbohydrates and lipids | (b) : 6.2 - Protein synthesis | (d) : 7.2 - Transport mechanisms

In the mesophyll tissue of leaves, products of photosynthesis can be used to synthesise organic compounds, such as the polysaccharide cellulose and some amino acids.

A source of nitrogen for amino acid synthesis can be provided by nitrate ions that have been taken up in the roots and transported to the leaves.

(a) Describe the structure of a cellulose molecule.

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..... [3]

(b) Studies of nitrate uptake and nitrate metabolism help to provide information to scientists who are investigating ways to increase the yield of crop plants.

The first step of nitrate metabolism in leaf cells is the reduction of nitrate to nitrite, catalysed by the enzyme nitrate reductase. The activity of the enzyme can be studied by detecting the presence of nitrite formed.

(i) Researchers have found that adding nitrate to leaf tissue results in an increase in messenger RNA (mRNA) molecules of the gene *NR*, which codes for nitrate reductase.

State **one** benefit to leaf cells of an increase in mRNA molecules of gene *NR* after the addition of nitrate.

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..... [1]



9



(ii) One method used to detect the presence of nitrite formed from the reduction of nitrate in leaf tissue involves:

- using an inhibitor to prevent nitrite from taking part in further reactions in the leaf tissue
- immersing the leaf tissue in a solution containing a colourless test reagent.

The nitrite from the leaf tissue enters the surrounding solution, changing the colour of the solution to magenta (red-purple).

Suggest why using a colorimeter can improve this method to detect the presence of nitrite.

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..... [2]

(c) In the leaf, transport of amino acids from mesophyll cells to companion cells involves using a number of different membrane transport proteins called amino acid transporters.

There is evidence that amino acids can move from the apoplast into the cytoplasm of a companion cell using the same transport mechanism that is used for sucrose transport.

(i) Outline **and** explain the sequence of events that occurs, which allows amino acids to be transported from the apoplast into the cytoplasm of a companion cell.

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..... [4]

(ii) Suggest why amino acid transporters are **not** needed to move amino acids from the companion cell into a phloem sieve tube element.

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..... [1]



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To investigate nitrate uptake, roots can be cut and removed (excised) and placed in a buffered solution containing nitrate ions. The root tissue can be analysed to determine the quantity of nitrate taken up over a set time period.

(d) Excised roots of the crop plant maize, *Zea mays*, were placed in three different concentrations of nitrate solution: 0.2 mmol dm^{-3} , 1.0 mmol dm^{-3} and 5.0 mmol dm^{-3} .

The solutions were maintained at 30°C and were aerated to provide a continuous supply of oxygen to the root tissue.

Nitrate (NO_3^-) uptake by the root tissue was determined each hour for five hours.

The results are shown in Fig. 4.1.

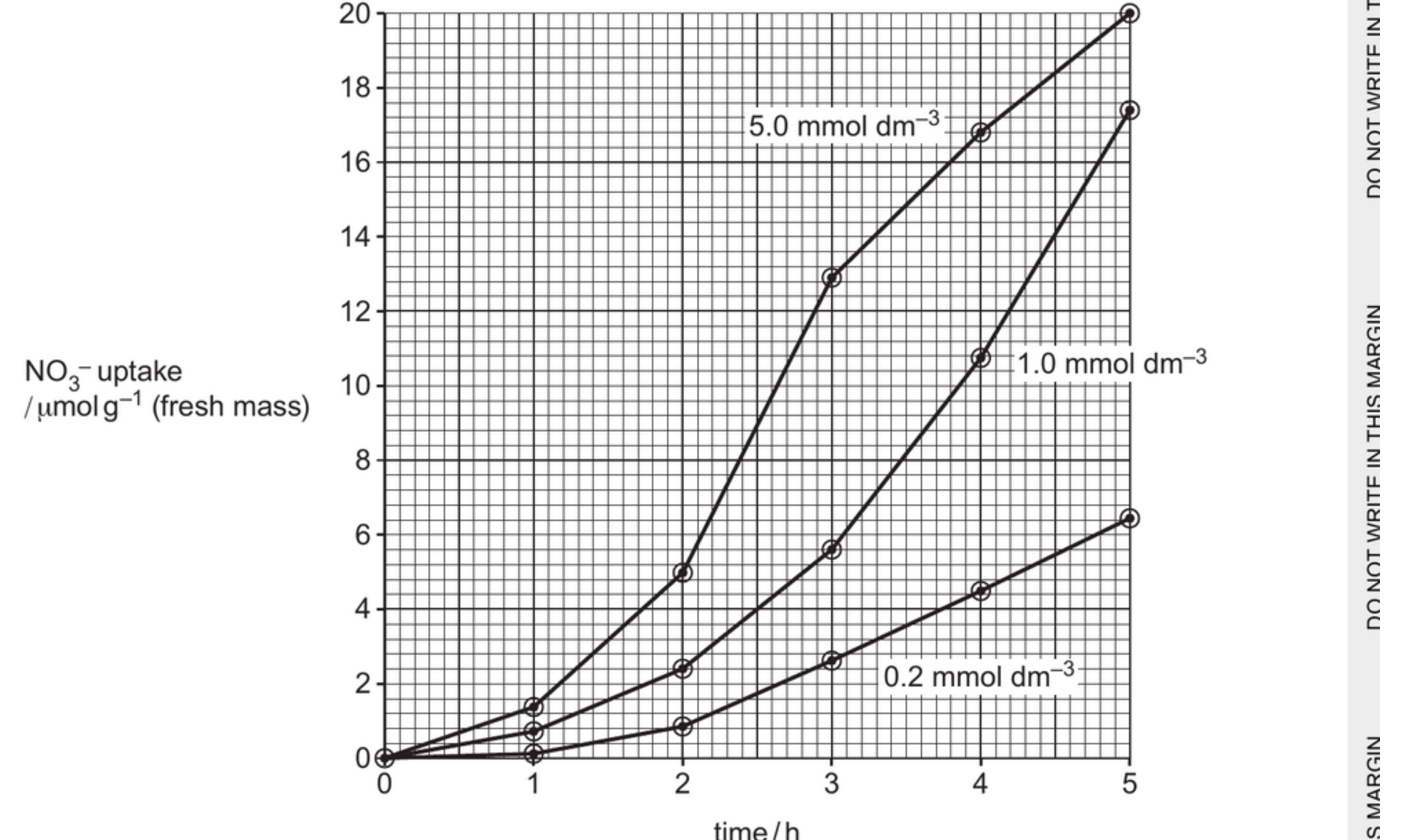


Fig. 4.1

Fig. 4.1 shows that the rate of nitrate uptake is very low initially and then increases for all three concentrations of nitrate solution tested.



11



Describe the **differences** in the **rates** of nitrate uptake for 5.0 mmol dm^{-3} nitrate solution compared with 0.2 mmol dm^{-3} nitrate solution, between 2h and 5h

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- how nitrate ions are taken up by the root cells
- the factors affecting the uptake of nitrate ions.

[4]

Question No 6 - (9700_s24_23_4)

Subsection Topics: (a) : 7.2 - Transport mechanisms | (b) : 3.1 - Mode of action of enzymes

Lignin and suberin are polymers that are present in plant tissues.

(a) Describe **and** explain the roles of lignin and suberin in the transport of water through the roots and stem of a plant.

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..... [4]

(b) The enzyme laccase catalyses the formation of lignin in plants.

Fig. 4.1 is a diagram of the mode of action of laccase.

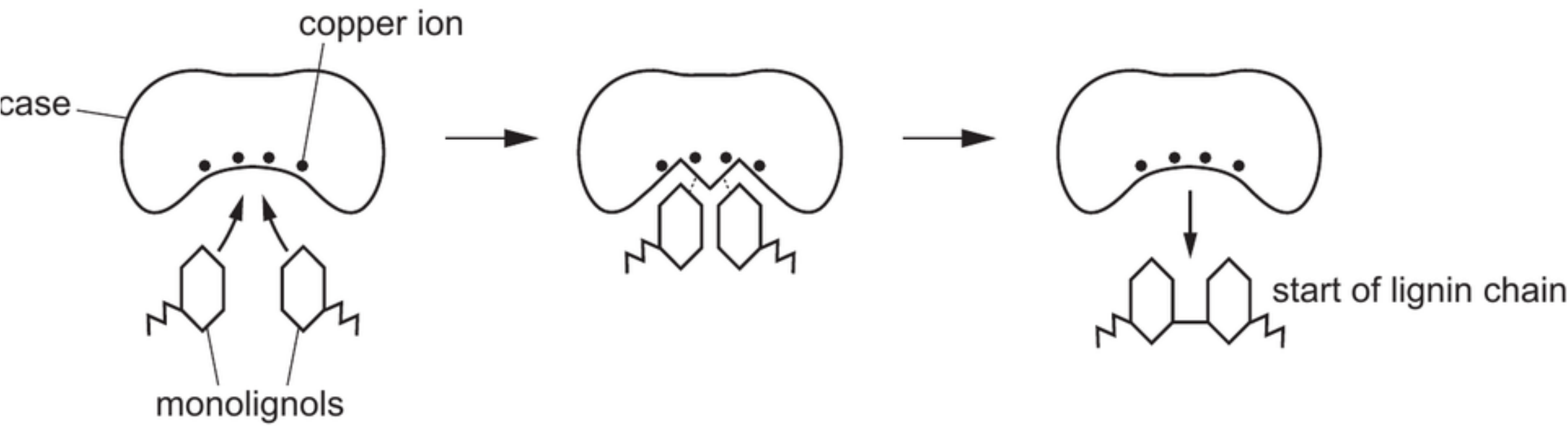


Fig. 4.1

- -

Describe **and** explain the mode of action of laccase when catalysing the formation of lignin.

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..... [5]

Question No 7 - (9700_w24_21_4)
Subsection Topics: (b) : 7.1 - Structure of transport tissues, 7.2 - Transport mechanisms | (c) : 6.1 - Structure of nucleic acids and replication of DNA | (a) : 2.2 - Carbohydrates and lipids

(a) Fig. 4.1 shows the structure of sucrose, a disaccharide produced by plant cells.

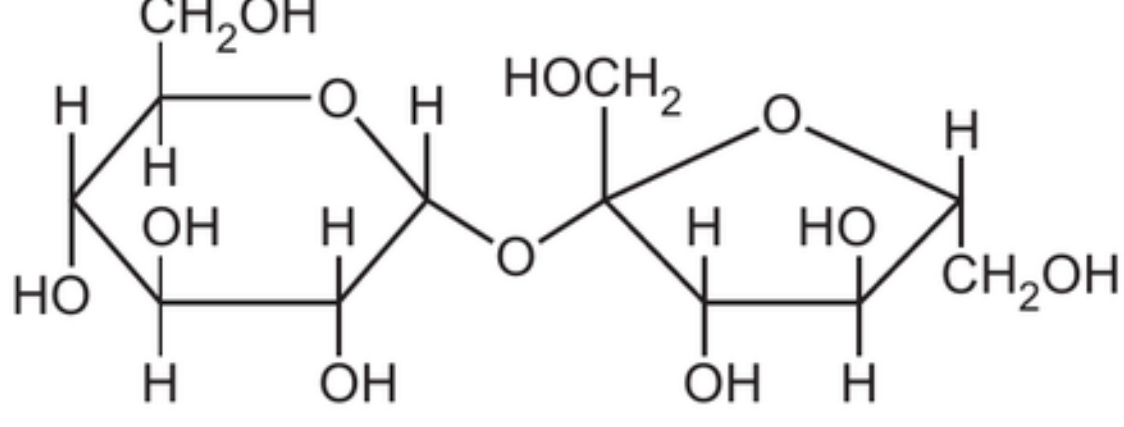
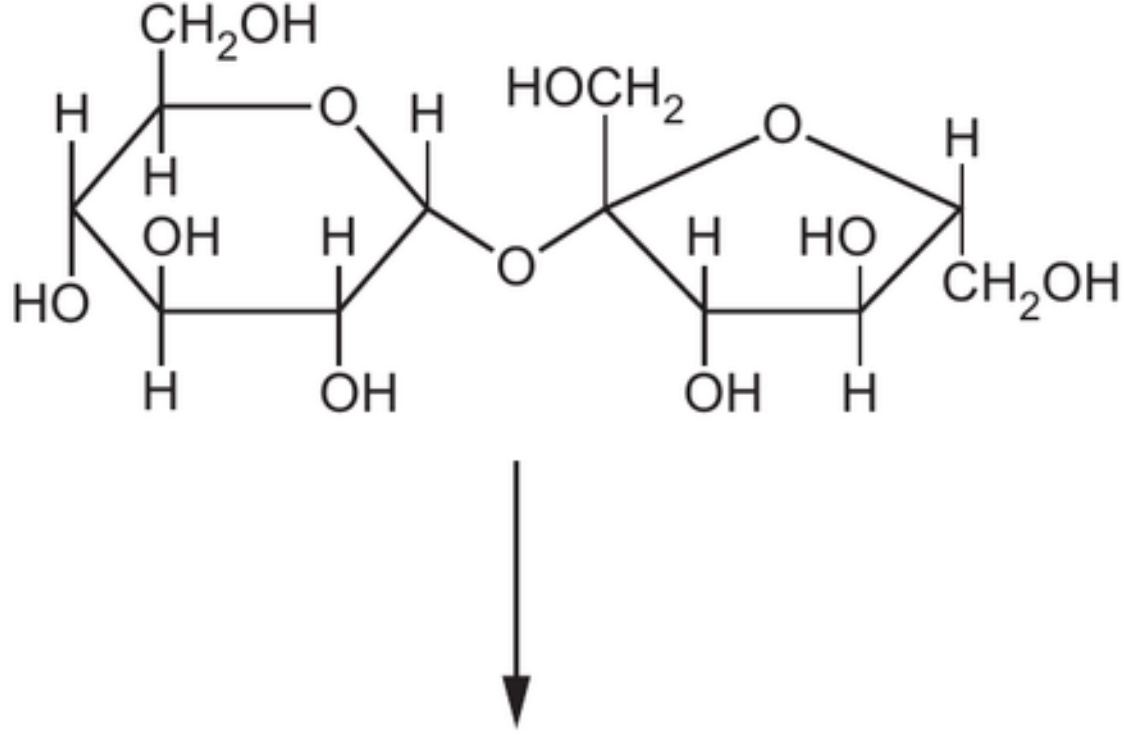


Fig. 4.1

- (i) Name the covalent bond that joins the two monomers in sucrose.
..... [1]
- (ii) Sucrose is hydrolysed by the enzyme sucrase in the human digestive system.
The products of this hydrolysis reaction are the monosaccharides α -glucose and fructose.
Complete the diagram to show the hydrolysis of sucrose to form α -glucose and fructose.



[3]

(b) Plants transport sucrose from a source to a sink.

Fig. 4.2 is a scanning electron micrograph (SEM) of a transverse section through a plant tissue used to transport sucrose.

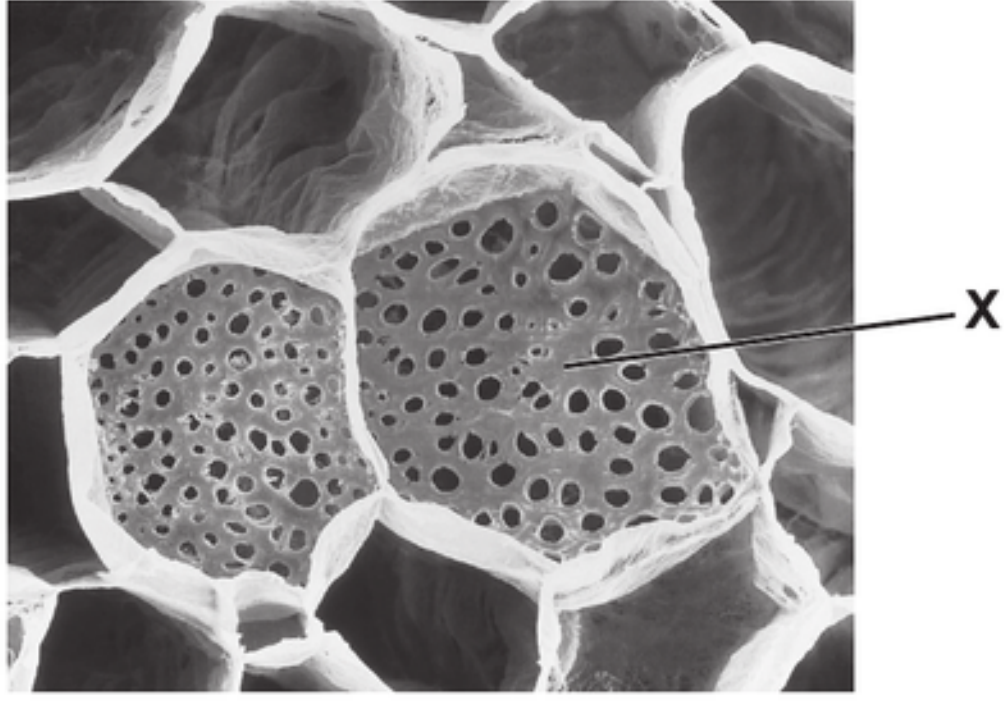


Fig. 4.2

- (i) Name the structure labelled X in Fig. 4.2.
..... [1]
- (ii) A scientist carried out an experiment to study carbohydrate transport in the stem of a woody plant.
Fig. 4.3 shows a plan diagram of a transverse section of the stem studied by the scientist.
The position of the xylem tissue in the stem is shown.

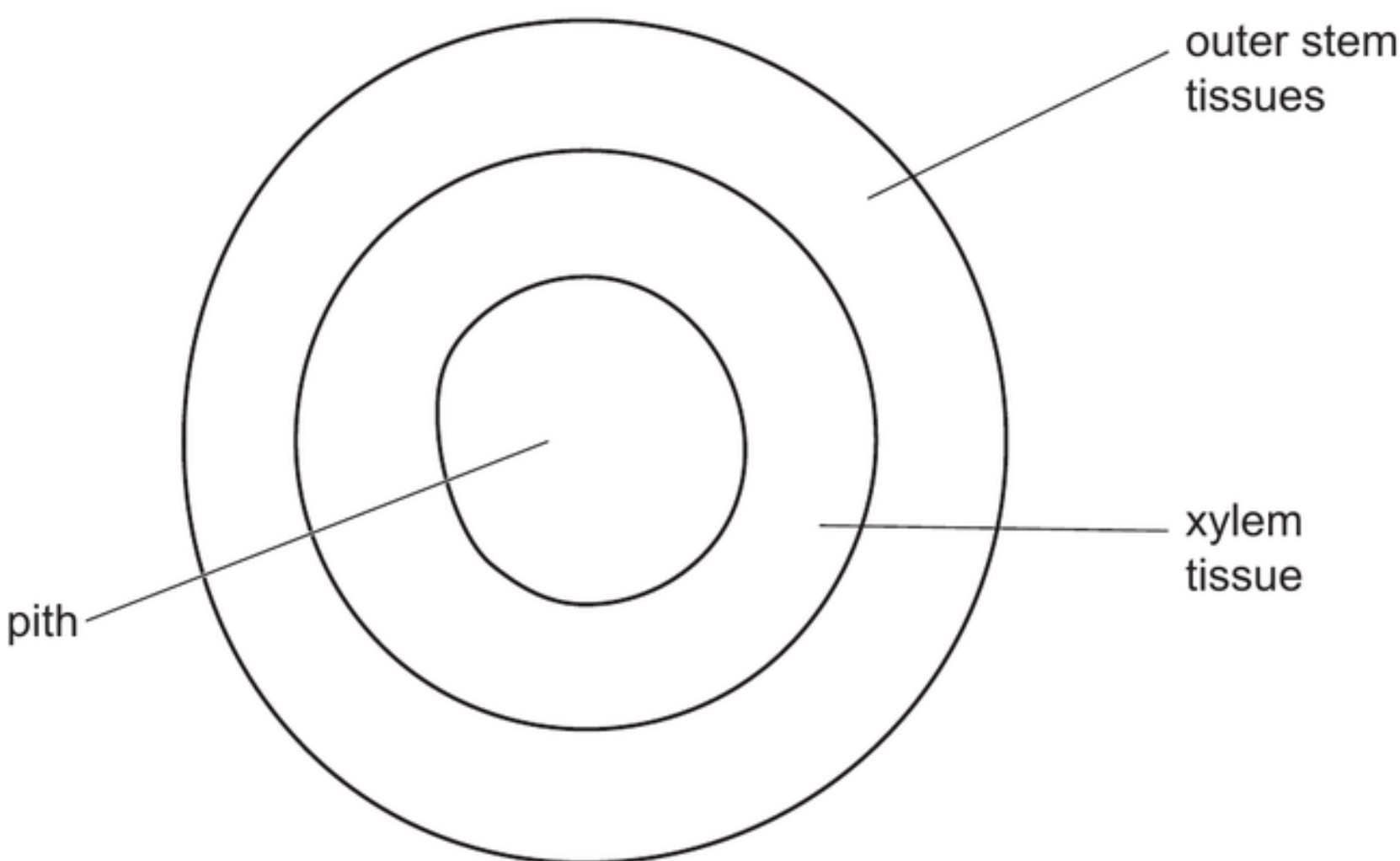


Fig. 4.3

The scientist carried out a set of experiments using plants of the same species.

In each experiment, a ring of tissue was removed from the outer stem of the plant, but the xylem tissue was left intact. This is shown in Fig. 4.4.

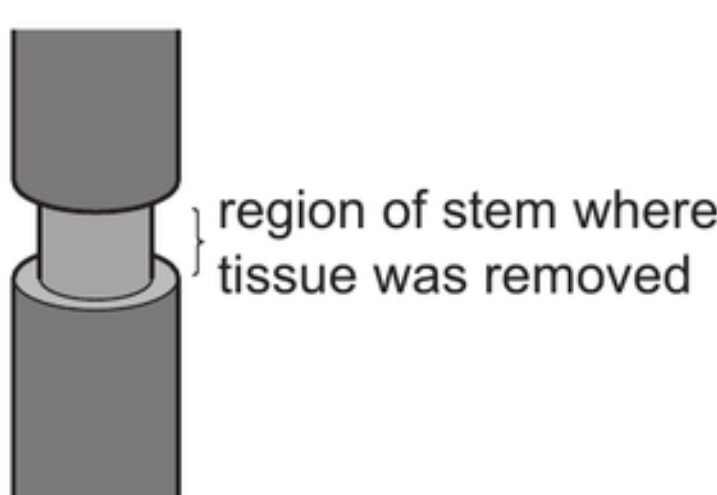


Fig. 4.4

The mass of carbohydrate transported to the lower part of the stem in 24 hours was recorded.

In each experiment a different percentage of the outer stem tissue was removed.

All other variables remained constant.

Table 4.1 shows the results of this investigation.

Table 4.1

percentage of outer stem tissue removed	mass of carbohydrate transported to lower part of the stem in 24 hours /mg
13	774
67	597
90	425
100	0

Explain the results shown in Table 4.1.

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(c) Sucrose is a sweet-tasting sugar found in many foods.

Some people become ill when they have sucrose in their diet. These people have a gene mutation in the gene coding for sucrase and cannot hydrolyse sucrose in the digestive system.

Scientists studying the DNA of people with this condition identified a deletion mutation in the gene coding for sucrase.

Suggest **and** explain why a person with this deletion mutation cannot digest sucrose.

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..... [4]

[Total: 13]

Question No 8 - (9700_w24_22_1)

Subsection Topics: (a) : 2.2 - Carbohydrates and lipids | (b) : 2.4 - Water | (c) : 7.1 - Structure of transport tissues

The olive plant, *Olea europaea*, is grown in many parts of the world. The fruits of the plant (olives) and the oil that can be obtained from the fruits (olive oil), provide food for humans.

Triglycerides are the main type of lipid in olive oil. They are synthesised in the olive plant from glycerol and fatty acids.

Scientists can analyse samples of different olive oils to identify:

- the fatty acids used to synthesise triglycerides
- the composition of the different triglycerides present.

(a) Table 1.1 shows some details of the five most common fatty acids found in samples of olive oil produced by olive plants grown in different regions in Portugal.

Table 1.1

Key

C : D = number of carbon atoms : number of double bonds in the hydrocarbon chain

X = missing detail

fatty acid	percentage of total fatty acid content	C : D	chemical structure
oleic acid	55.0–83.0	18 : 1	CH ₃ (CH ₂) ₇ CH=CH(CH ₂) ₇ X
palmitic acid	7.5–20.0	16 :	CH ₃ (CH ₂) ₁₄ X
linoleic acid	3.5–21.0	18 :	CH ₃ (CH ₂) ₄ (CH=CH)CH ₂ (CH=CH)(CH ₂) ₇ X
stearic acid	0.5–5.0	18 :	CH ₃ (CH ₂) ₁₆ X
palmitoleic acid	0.3–3.5	16 :	CH ₃ (CH ₂) ₅ CH=CH(CH ₂) ₇ X

(i) Table 1.1 shows the **C : D** values for oleic acid.

In Table 1.1, write the values for **D** for each of the four other fatty acids listed. [1]

(ii) In the first column of Table 1.1, draw a circle around each of the fatty acids that can be described as saturated. [1]

(iii) State the detail of chemical structure, represented by **X**, which is missing from Table 1.1. [1]



(iv) The analysis of the triglycerides present in the different samples of olive oil showed that:

- there are many different triglycerides present in olive oil
- each olive oil is different in its composition, but the same few triglycerides are present in all olive oils.

With reference to Table 1.1 and to the structure of triglycerides, suggest explanations for these observations.

..... [2]

(b) Glycerol is soluble in water. Triglycerides are insoluble in water.

Explain why water is a good solvent for some substances such as glycerol, but is a poor solvent for substances such as triglycerides.

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solvent for substances such as triglycerides.

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- (c) Phloem is the plant tissue responsible for the transport of organic substances, such as fatty acids, from one area of a plant to another. The tissue is composed of more than one type of cell.

Name the type of cell that forms the transport vessels of phloem tissue.

..... [1]

[Total: 8]

Question No 9 - (9700_w24_22_6)

Subsection Topics: (a) : 7.2 - Transport mechanisms | (b) : 4.2 - Movement into and out of cells

6 The transport of water from the soil solution to the xylem of roots occurs by the apoplast and symplast pathways. Mineral ions can be transported dissolved in water.

(a) Describe the transport of water from the soil solution to the endodermis of roots by the **apoplast** pathway **and** explain why this pathway cannot continue at the endodermis.

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..... [4]

(b) Researchers investigated the mechanism of transport used for the uptake of potassium ions (K⁺) into root epidermal cells at different concentrations of K⁺ in the soil solution.

Complete Table 6.1 to provide information about the two different transport mechanisms that were identified by the researchers.

Table 6.1

net movement of K ⁺	membrane protein needed (yes or no)	ATP used (yes or no)	name of transport mechanism
against the concentration gradient			
down the concentration gradient			

[3]

[Total: 7]

Question No 10 - (9700_m23_22_3)

Subsection Topics: (a) : 7.1 - Structure of transport tissues | (b) : 7.2 - Transport mechanisms

(a) Fig. 3.1 is a diagram of an area of phloem tissue from a transverse section through the stem of a squash plant, *Cucurbita pepo*.

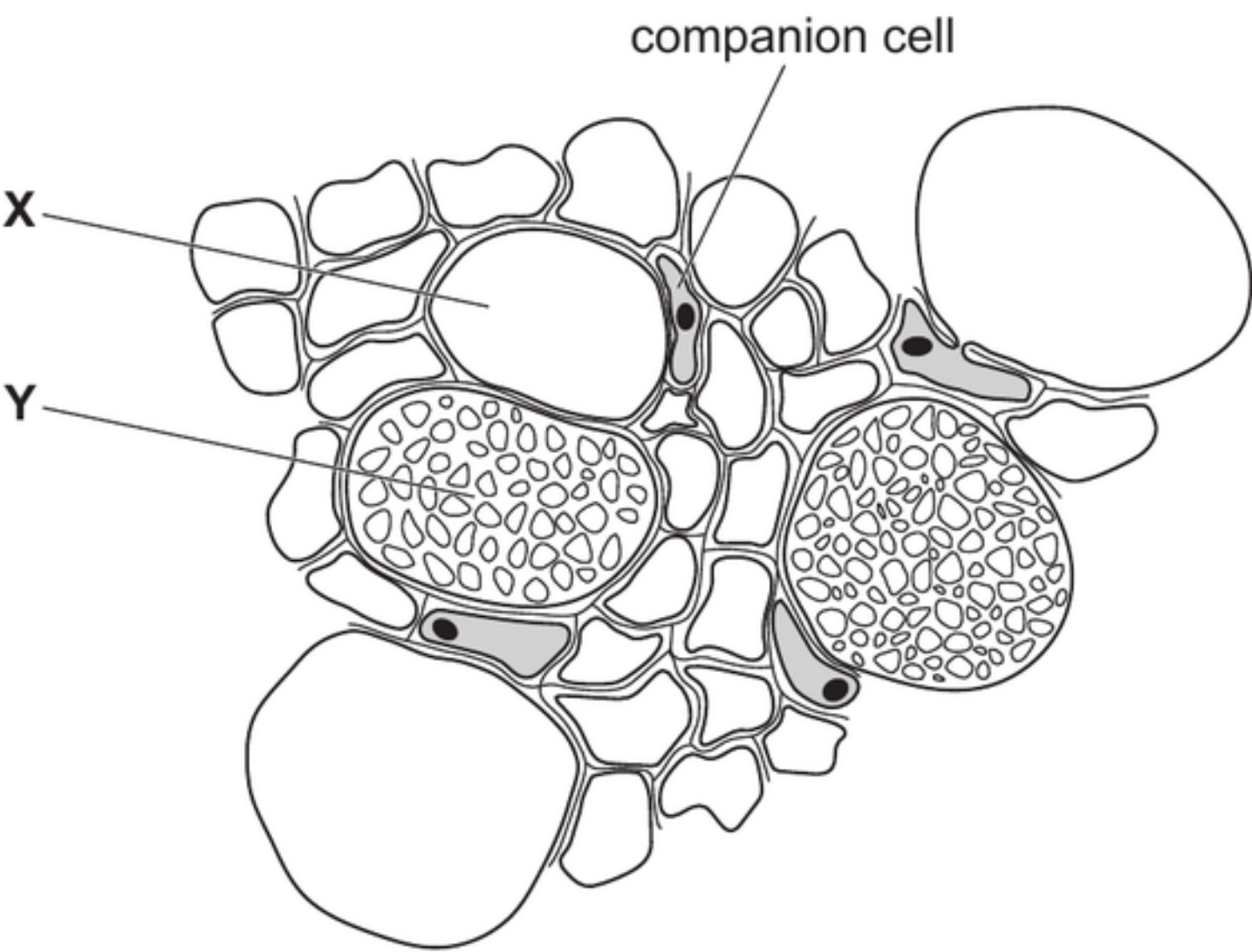


Fig. 3.1

(i) Cell **X** and cell **Y** in Fig. 3.1 are sieve tube elements.

Explain why cell **X** and cell **Y** have very different appearances in this transverse section.

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..... [2]

(ii) Sucrose is formed from the glucose synthesised by mesophyll cells in the leaves of *C. pepo*.

Explain how companion cells are involved in the transfer of sucrose into phloem sieve tubes.

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(b) Hydrogen bonding is important in the movement of water in xylem.

(i) Explain how hydrogen bonding occurs between two water molecules.

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(ii) Outline how hydrogen bonding is involved in water transport in the xylem of a plant stem.

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..... [3]

(iii) Hydrogen bonding between water molecules gives water a relatively high latent heat of vaporisation.

Suggest why it is important to plants that water has a high latent heat of vaporisation.

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..... [2]

[Total: 13]

Question No 11 - (9700_s23_21_6)

Subsection Topics: (a) : 7.2 - Transport mechanisms | (b) : 7.2 - Transport mechanisms | (c) : 7.2 - Transport mechanisms

Fig. 6.1 is a diagram showing the passage of water through the tissues of a flowering plant from the soil to the atmosphere. The arrows show the direction of water movement.

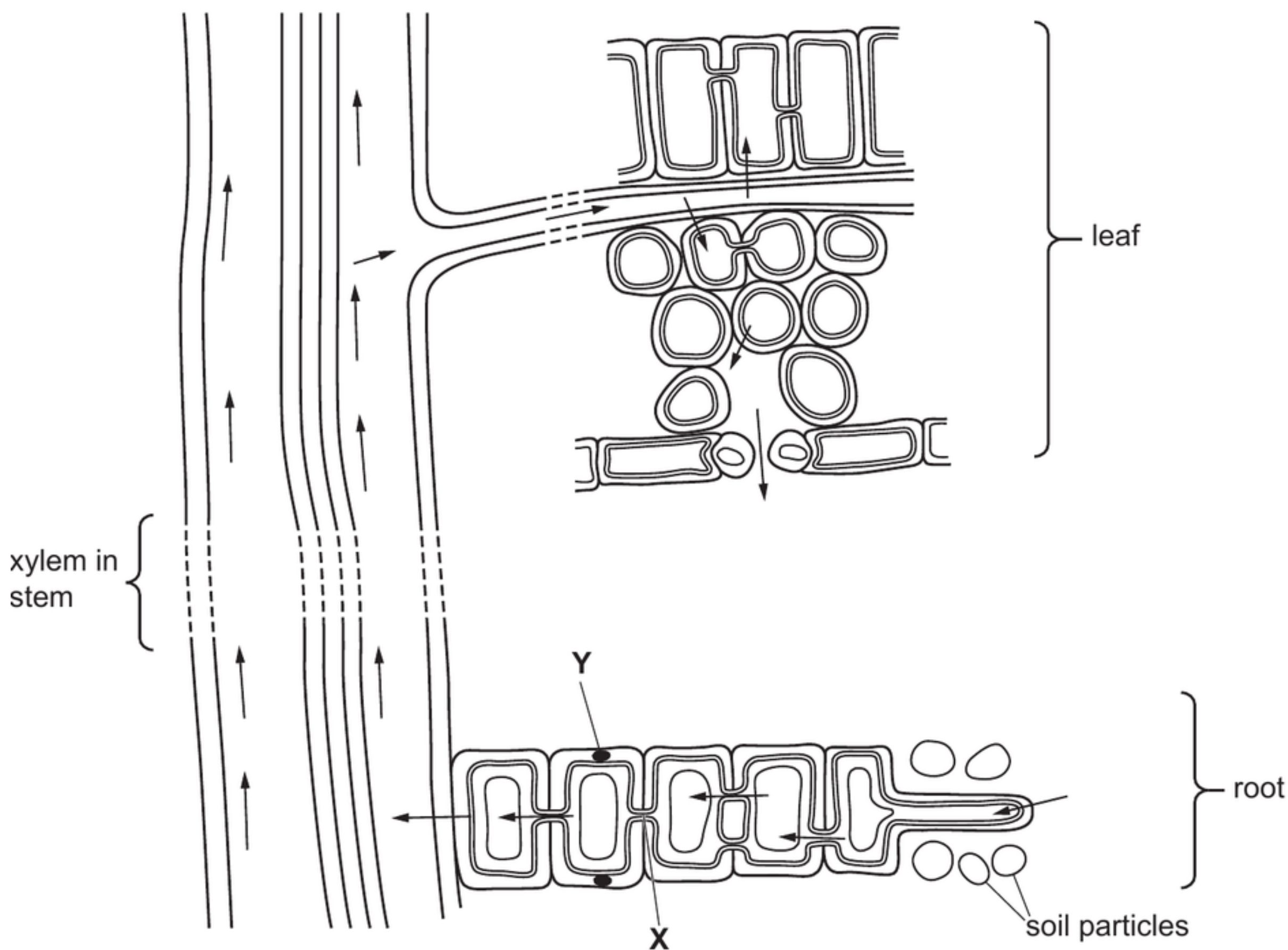


Fig. 6.1

- (a) The structure labelled **X** is part of the symplast pathway. State the name of structure **X**.

..... [1]

- (b) The structure labelled **Y** in the cell wall is a barrier to the apoplast pathway. State the name of structure **Y**.

..... [1]

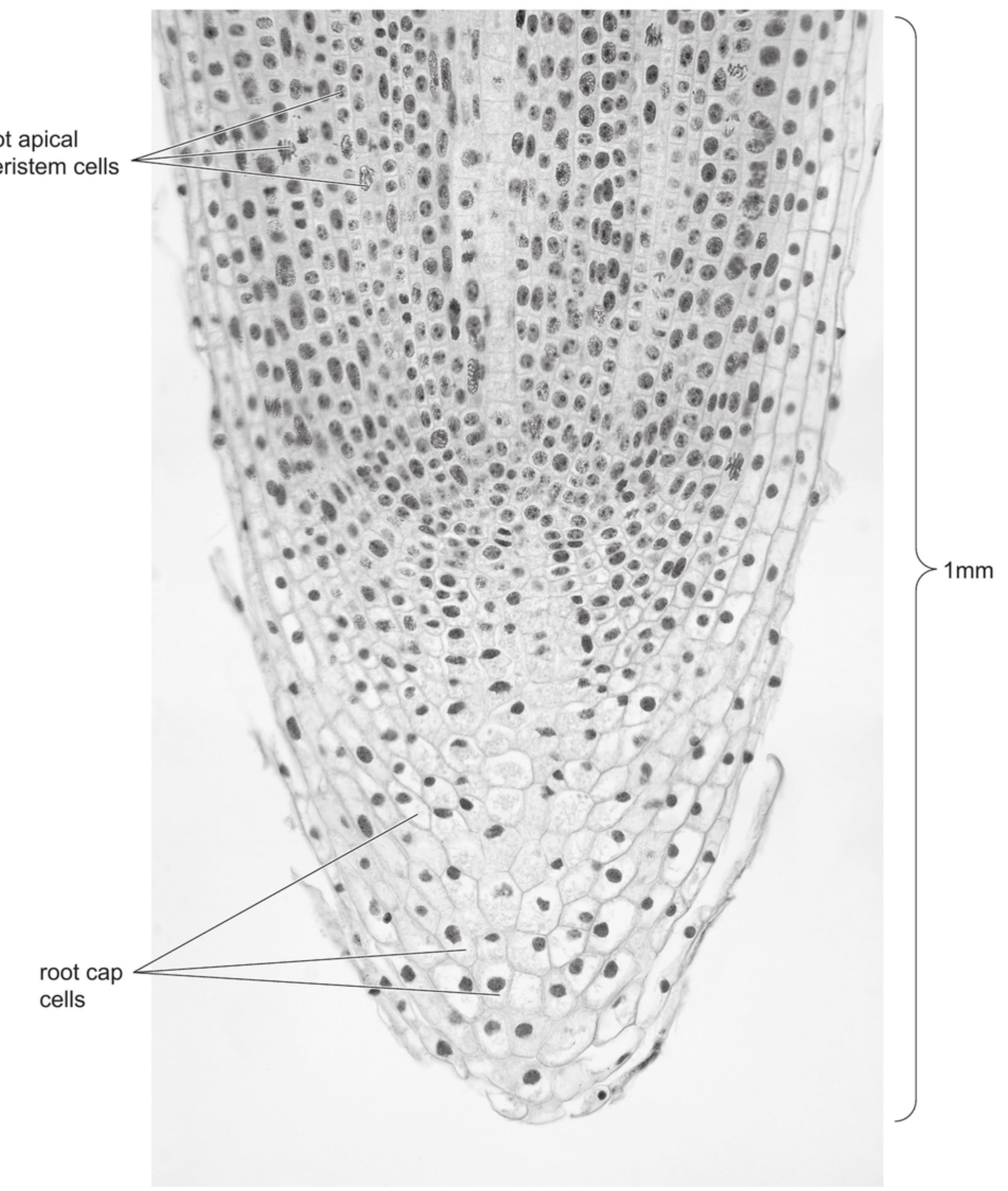
- (c) With reference to Fig. 6.1, complete the statements about the movement of water in the flowering plant.

Question No 12 - (9700_s23_22_2)
Subsection Topics: (a) : 7.2 - Transport mechanisms | (b) : 2.4 - Water | (c) : 3.1 - Mode of action of enzymes | (d) : 2.2 - Carbohydrates and lipids

Fig. 2.1 is a photomicrograph of a longitudinal section (LS) through a root tip. Two different regions are visible:

- the root apical meristem
- the root cap.

Cells in the root cap synthesise a gel-like, sticky secretion known as mucilage, which is important in reducing friction between soil and the growing root. It is composed mainly of polysaccharides and also contains some amino acids and enzymes.



(a) Describe **three** differences, **visible** in Fig. 2.1, between root apical meristem cells and root cap cells.

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[3]

(b) Mucilage acts as a glue to bind tiny soil particles together, forming small clumps close to the root. These small clumps help to maintain the soil water around the root tip and prevent the loss of water.

With reference to the cohesive **and** adhesive properties of water, suggest **and** explain how the formation of small clumps of soil helps to maintain the soil water around the root tip.

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[3]

(c) Enzymes present in mucilage catalyse the breakdown of organic compounds in the soil. This increases the presence of mineral ions in the soil.

State the term used to describe enzymes that act **outside** the cells that synthesise them.

.....

[1]

(d) The polysaccharides and amino acids present in the mucilage are a source of nutrients for soil microorganisms that live in the area surrounding the root. Some of these microorganisms can break down soil compounds to release mineral ions.

(i) Explain what is meant by a polysaccharide.

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..... [2]

(ii) The soil microorganisms use amino acids to synthesise proteins. All of the twenty different amino acids that are present in proteins have the same general structure.

Draw the general structure of an amino acid in the space provided **and** use this drawing to explain how it is possible to have many different amino acids.

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(iii) Mineral ions are usually present in the soil in very low concentrations. The action of mucilage enzymes and soil microorganisms can help to increase the presence of mineral ions.

Root hair cells are specialised for the uptake of these mineral ions **and** for the absorption of water from the soil.

Suggest **and** explain how the presence of mineral ions in the root hair cell can **increase** the absorption of water by the root hair cells.

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..... [3]

Question No 13 - (9700_s23_23_5)

Subsection Topics: (a) : 7.1 - Structure of transport tissues | (b) : 7.2 - Transport mechanisms | (c) : 2.2 - Carbohydrates and lipids

Phloem and xylem are specialised tissues involved in the transport of water, ions and assimilates in plants.

(a) A photomicrograph of a transverse section of a dicotyledonous stem is shown in Fig. 5.1.



Fig. 5.1

Use label lines and labels to identify the phloem tissue **and** xylem tissue in Fig. 5.1. [2]

(b) (i) Describe how sucrose is transported in phloem sieve tubes from photosynthesising leaves to other parts of the plant.

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..... [4]

(ii) Cyanide ions (CN⁻) inhibit the activity of an enzyme involved in respiration.

Suggest why the treatment of photosynthesising leaves with CN⁻ results in less sucrose being transported into phloem sieve tubes.

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..... [2]

- (c) A student was asked to carry out semi-quantitative Benedict’s tests on two solutions.
- Solution **A** was extracted from the cytoplasm of cells in the mesophyll tissue of photosynthesising leaves.
 - Solution **B** was extracted from the phloem sap in phloem sieve tubes.

The solutions were taken from the same plant, and other variables were standardised.

For each solution, the student measured the time taken for the first colour change to appear.

Suggest which of the two solutions, **A** or **B**, would change colour in the shortest time.

Explain your answer.

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..... [2]

Question No 14 - (9700_s23_23_4)

Subsection Topics: (a) : 2.3 - Proteins | (b) : 7.2 - Transport mechanisms

Food crops such as barley and wheat contain gluten. Gluten contains two proteins, glutenin and gliadin.

(a) (i) Table 4.1 contains descriptions of the structures of glutenin and gliadin.

Complete Table 4.1 by writing the level of protein structure that applies to each description.

Table 4.1

description	level of protein structure
gliadin protein is a single polypeptide that forms compact structure	
50% of the amino acids in a glutenin molecule are cysteine	
gliadin and glutenin molecules contain regions of β -pleated sheets	

[3]

(ii) Many genes in eukaryotic cells contain introns. The genes that code for gliadin do **not** contain introns.

Explain how a lack of introns in a gliadin gene affects the production of mRNA from the primary transcript.

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..... [1]

(b) Coeliac disease is a condition in which the immune system of a person responds to gluten in their diet.

In coeliac disease, there is a response to the presence of peptides (short chains of amino acids) that are produced as a result of gliadin digestion.

(i) The gliadin peptides produced as result of digestion are often as large as 33 amino acids in length. Intestinal cells take up large numbers of these peptides at the same time.

Suggest **and** explain how gliadin peptides are transported into intestinal cells.

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..... [2]

(ii) The presence of gliadin causes the immune system of a person with coeliac disease to respond by producing anti-gliadin antibodies.

Describe the sequence of events that results in the immune system producing anti-gliadin antibodies.

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..... [4]

Question No 15 - (9700_w23_21_3)

Subsection Topics: (a) : 7.2 - Transport mechanisms | (b) : 2.2 - Carbohydrates and lipids | (c) : 7.2 - Transport mechanisms | (d) : 2.4 - Water

Plants have specialised cells for the efficient transport of assimilates.

- (a) Table 3.1 shows some of the features of two different types of cell found in plant tissue, which are adapted for the efficient transport of assimilates.

Table 3.1

feature of cell	cell type A	cell type B
cytoplasm	✓	✓
nucleus	✗	✓
mitochondria	few	many
cellulose in the cell wall	✓	✓
ribosomes	✗	✓

Key
✓ present
✗ absent

Many plasmodesmata connect type **A** cells with type **B** cells.

Identify cell type **A** and explain why the plasmodesmata are important.

cell type **A**

explanation

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[3]

- (b) The polysaccharide callose is found in the cell walls of cells close to plasmodesmata.

Fig. 3.1 is a simplified diagram showing the structure of callose. Not all hydrogen atoms are shown.

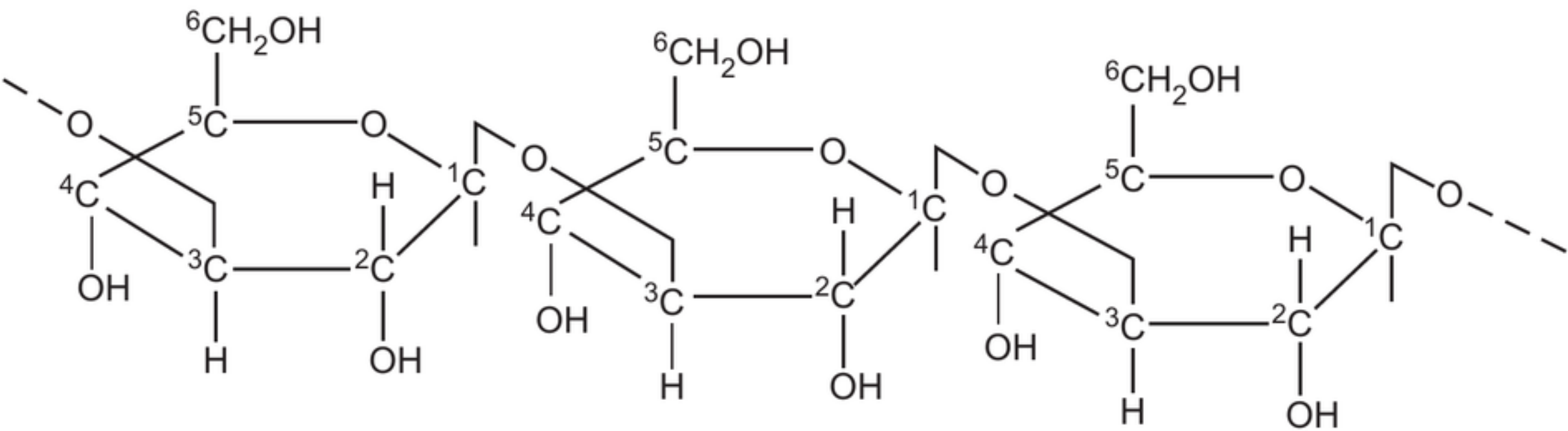


Fig. 3.1

Complete Table 3.2 to compare the structure of a callose molecule with a cellulose molecule.

Table 3.2

feature of polysaccharide	callose molecule	cellulose molecule
monosaccharide used to synthesise the polysaccharide	β-glucose	
bond connecting the monomers		1,4 glycosidic bond
shape of molecule	helix	
orientation of monosaccharides in the molecule		alternate glucose molecules are rotated by 180°

[4]

- (c) Hydrogen bonding is important for movement of water through xylem vessels in a plant.

Describe the roles of hydrogen bonding in the movement of water through xylem vessels.

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[2]

- (d) Water that has travelled through xylem vessels reaches the leaves. Cooling of the leaf occurs as a result of the evaporation of water during transpiration.

Water has a high latent heat of vaporisation because water molecules form hydrogen bonds.

With reference to hydrogen bonding, suggest why cooling of the leaf occurs as a result of evaporation of water during transpiration.

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..... [2]

[Total: 12]

Question No 16 - (9700_w23_21_2)

Subsection Topics: (a) : 1.2 - Cells as the basic units of living organisms | (b) : 2.3 - Proteins, 2.2 - Carbohydrates and lipids, 11.1 - The immune system | (c) : 6.1 - Structure of nucleic acids and replication of DNA, 6.2 - Protein synthesis

Fig. 2.1 is a transmission electron micrograph showing a section of a specialised epithelial cell found in the lining of the stomach. This cell produces extracellular proteins that are released into the bloodstream.

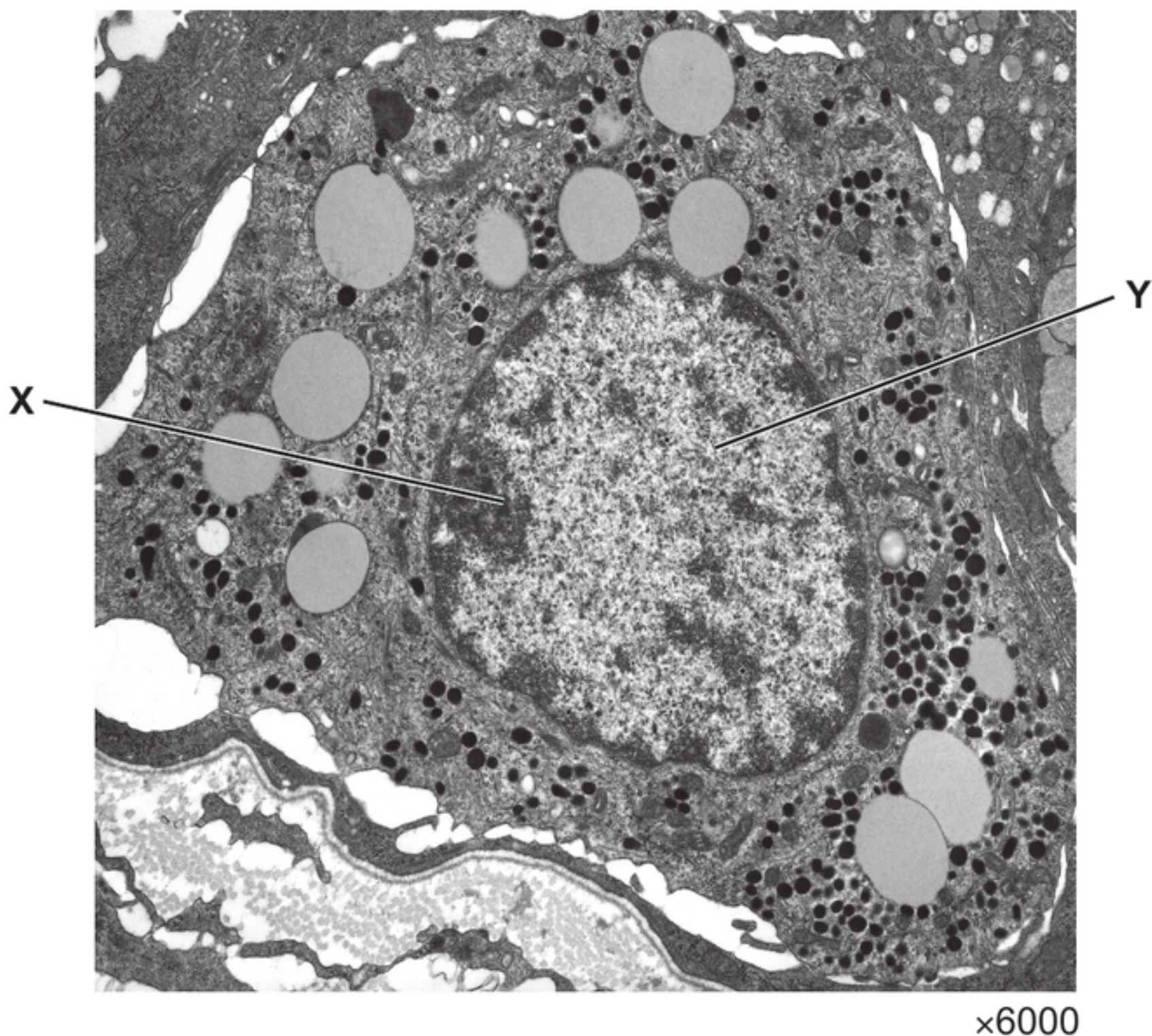


Fig. 2.1

(a) Outline the role of structure X and structure Y, as shown in Fig. 2.1, in the production of extracellular proteins.

structure X

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.....

structure Y

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.....

[2]

(b) The cell in Fig. 2.1 releases ghrelin, a small protein that acts as a cell signalling molecule.

Fig. 2.2 shows the sequence of amino acids in a ghrelin molecule.

The amino acid serine (Ser) in position 3 in Fig. 2.2 has been modified by the addition of a saturated fatty acid chain.

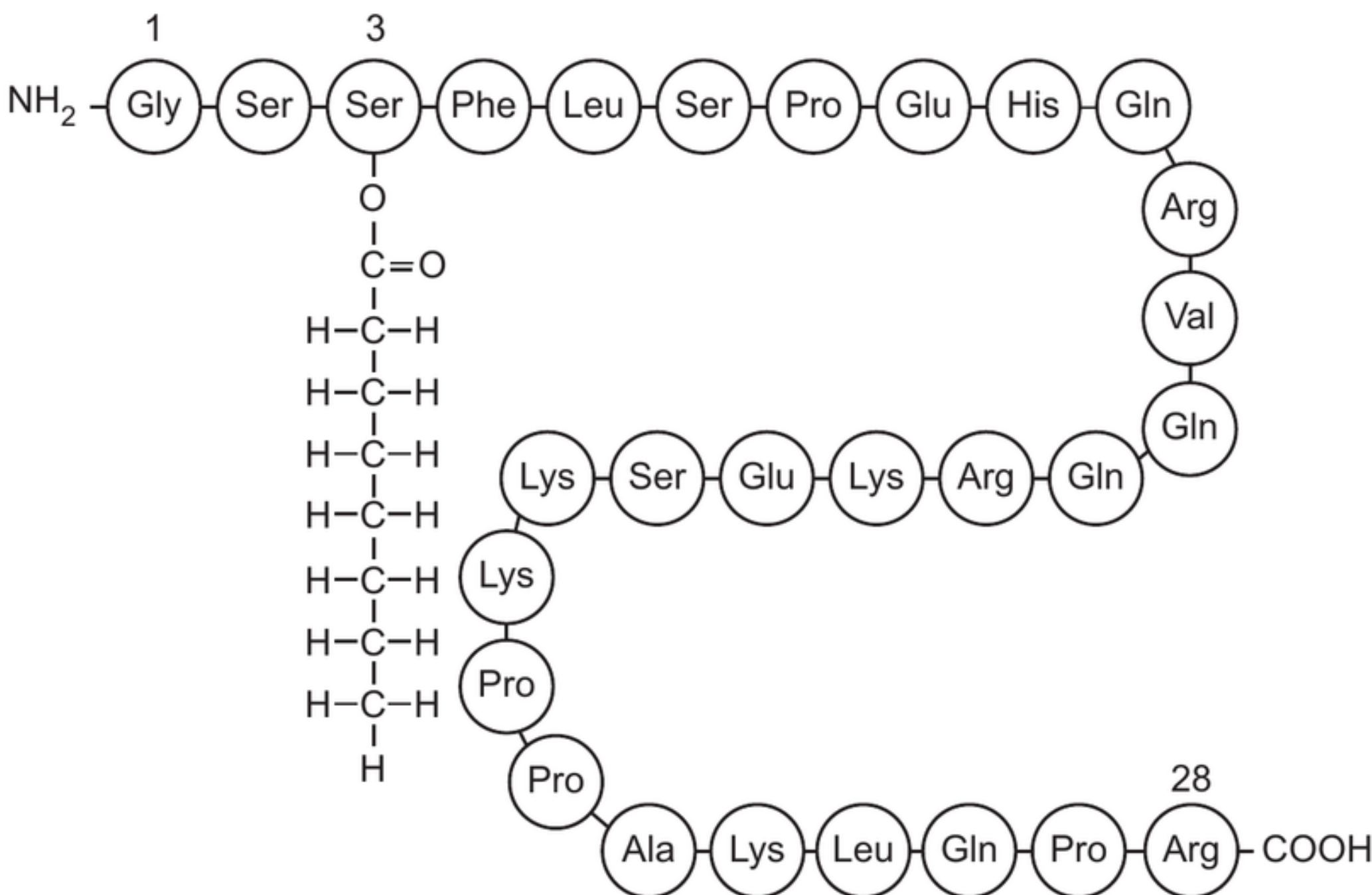


Fig. 2.2

(i) State the level of protein structure shown in Fig. 2.2.

..... [1]

(ii) State **one** similarity between the structure of a saturated fatty acid molecule and an amino acid molecule.

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..... [1]

(iii) The addition of the fatty acid chain allows ghrelin to function as a cell signalling molecule.

Suggest how the addition of this fatty acid chain allows a ghrelin molecule to act as a cell signalling molecule.

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..... [3]

(c) Scientists have discovered that the gene coding for ghrelin contains 5000 base pairs. This is a much larger number of base pairs than is needed to code for the ghrelin molecule shown in Fig. 2.2.

(i) Calculate the percentage of base pairs found in the gene that codes for the ghrelin molecule shown in Fig. 2.2.

Show your working and give your answer to one decimal place.

..... [2]

(ii) The primary transcript produced from the ghrelin gene is a longer molecule than the mRNA found in the cytoplasm.

Explain how the primary transcript is modified before translation.

Question No 17 - (9700_w23_22_6)

Subsection Topics: (a) : 7.1 - Structure of transport tissues | (b) : 7.2 - Transport mechanisms | (c) : 7.1 - Structure of transport tissues

Water that is absorbed from the soil solution by the roots of a plant enters xylem vessels and is transported to the leaves and buds.

Fig. 6.1 shows four important requirements for the efficient transport of water from the roots to the leaves of a plant.

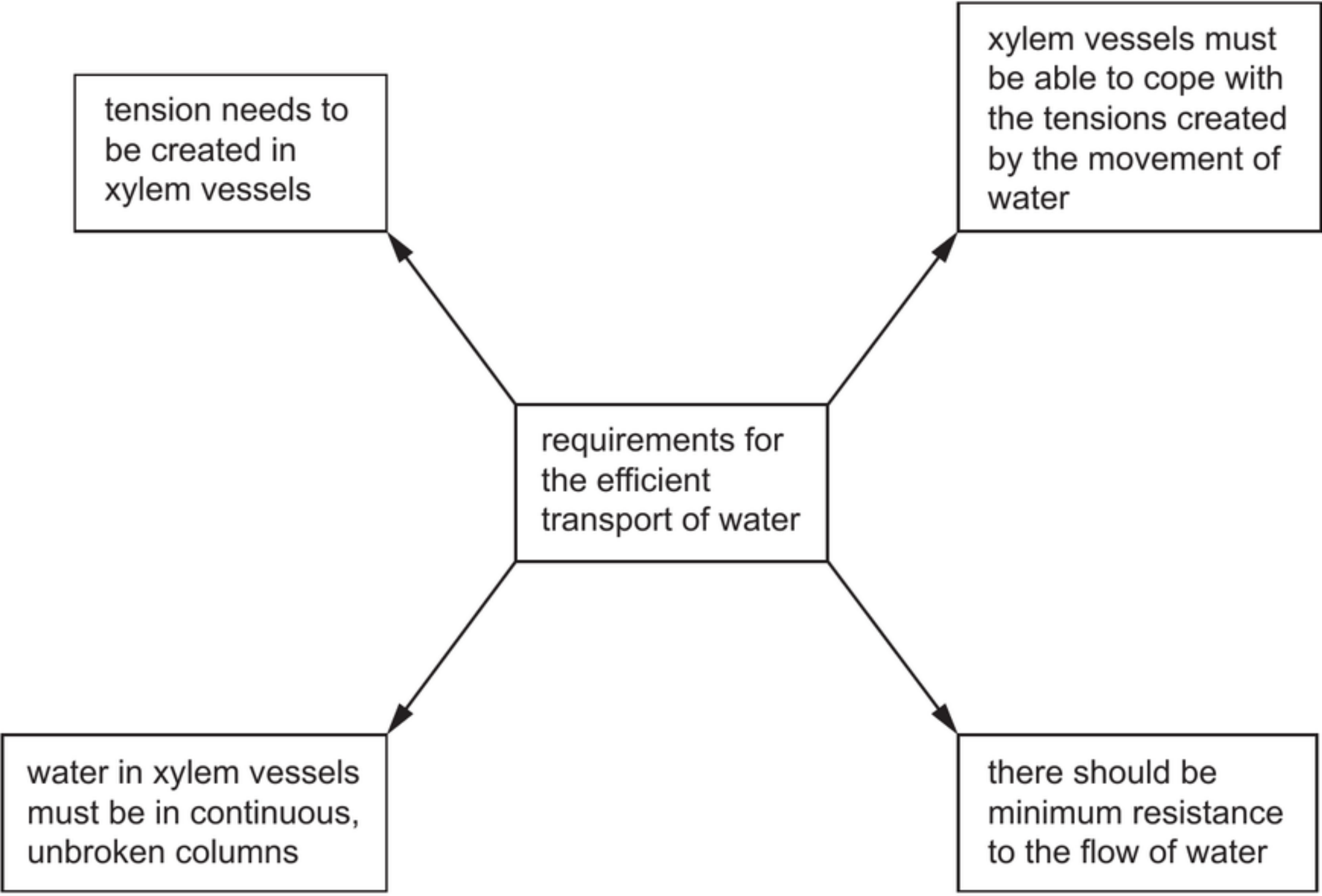


Fig. 6.1

- (a) Name the specialised cells that are arranged end to end to form xylem vessels.

..... [1]
- (b) Explain how tension is created in the xylem vessels.

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..... [2]

(c) Fig. 6.1 highlights how the structure of xylem vessels must be related to their function. This means that during the development of xylem vessels changes need to occur to the cells forming the vessels.

(i) The walls of the cells forming the xylem vessel walls become lignified during development.

Explain how this feature is important for the efficient transport of water.

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..... [2]

(ii) During the development of xylem vessels, the end walls of the cells forming the vessels break down. This contributes to minimising resistance to the flow of water.

Describe **one** other main change that needs to occur to these cells so that their structure becomes suited to their function.

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..... [1]

Question No 18 - (9700_w23_22_2)
Subsection Topics: (a) : 2.3 - Proteins | (b) : 2.3 - Proteins | (c) : 2.3 - Proteins | (d) : 3.2 - Factors that affect enzyme action | (e) : 3.2 - Factors that affect enzyme action

Keratin is the structural protein in feathers of birds. Keratin polypeptides are composed of a high proportion of cysteine amino acids, which have sulfur-containing R groups.

Keratin polypeptides form filaments. The two main types of keratin in feathers are α -keratin, which consists of many α -helices, and β -keratin, consisting of many β -pleated sheets.

(a) Keratin can be classified as α -keratin or β -keratin based on a study of protein structure.

Suggest the level of protein structure used to classify a protein as α -keratin or β -keratin.

..... [1]

(b) Protease enzymes hydrolyse proteins. Many proteases are able to hydrolyse more than one type of protein.

Suggest why it is possible for a protease to act on different types of protein.

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..... [1]

(c) Proteases known as keratinases vary in the extent to which they can hydrolyse keratin.

Feathers are not easily degraded (broken down) because keratin is a very stable protein.

Suggest features of keratin structure that contribute to its stability.

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..... [3]

Keratinases are used to degrade the large quantities of waste feathers from chickens and turkeys that are processed in the food industry. The products of feather degradation can be used in animal feed.

Scientists investigated whether three different keratinases, K12, A22 and P3, were suitable as industrial enzymes. These enzymes were extracted from three different soil bacteria.

The effects of temperature and pH on the activity of each keratinase were investigated.

The results are shown in Fig. 2.1 and Fig. 2.2.

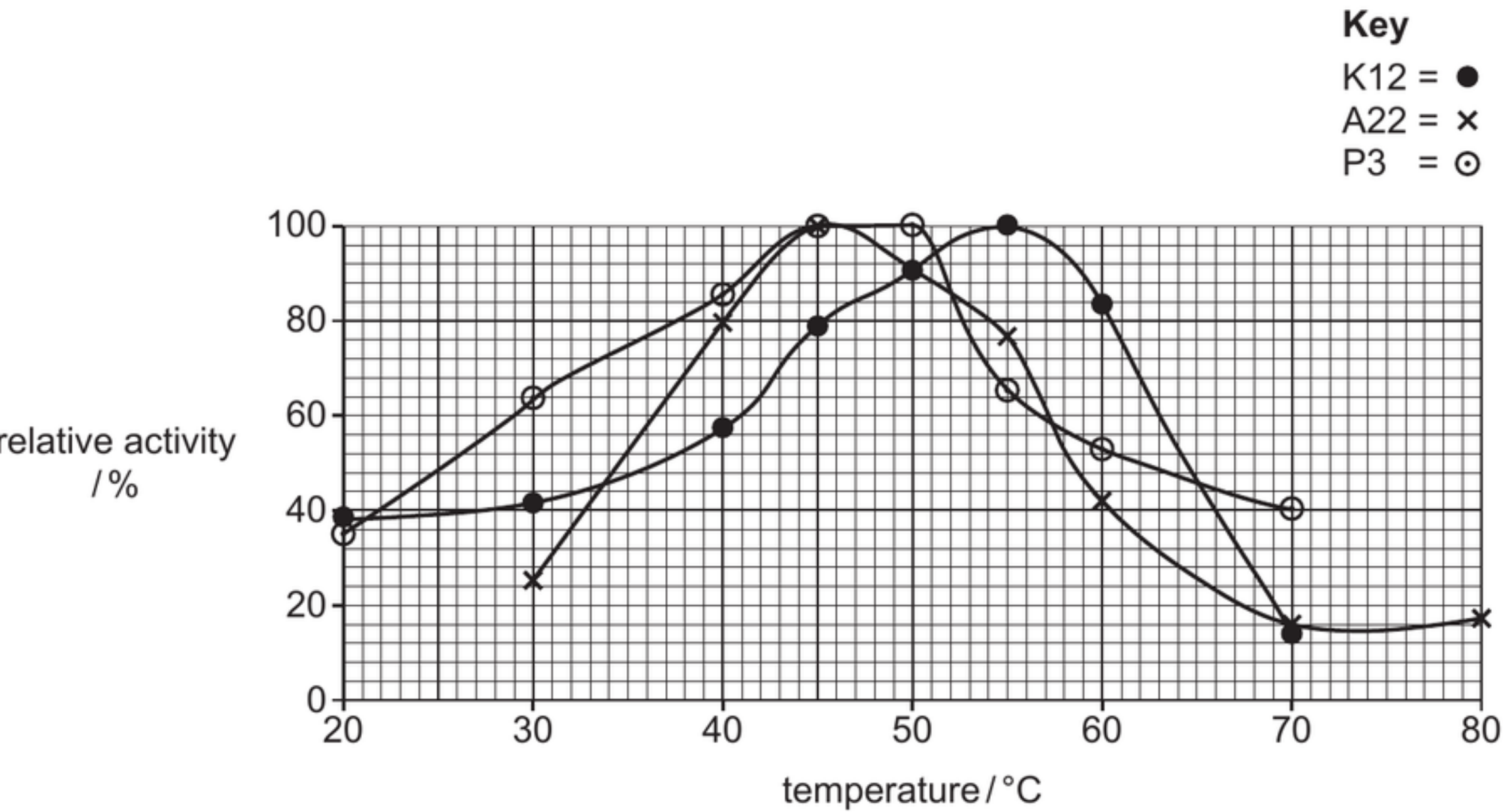


Fig. 2.1

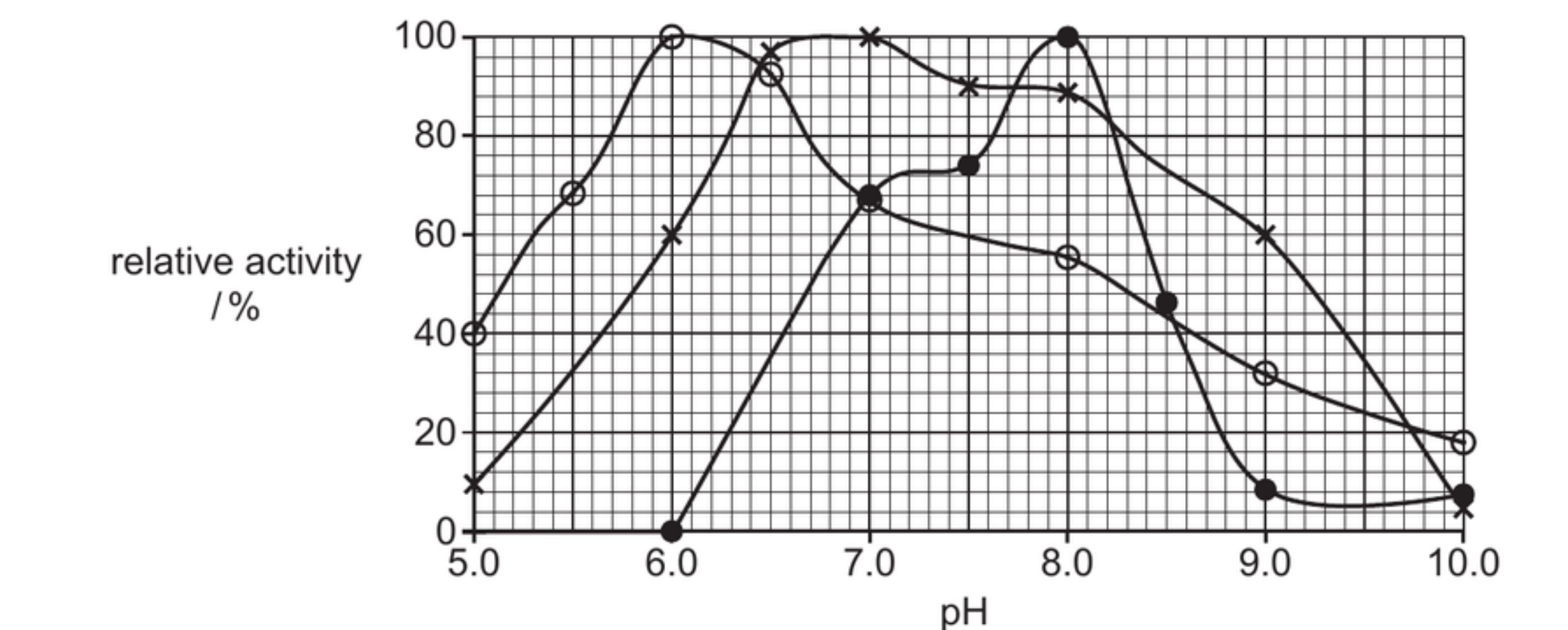


Fig. 2.2

(d) To degrade feather waste from industry, it is an advantage to use keratinases that show at least 60% relative activity in conditions where temperature and pH can vary widely.

Table 2.1 shows, for each keratinase, the working range of temperature and pH where at least 60% relative activity is obtained.

Use Fig. 2.1 and Fig. 2.2 to complete Table 2.1 **and** use the completed table to:

- name the keratinase that has the widest working range of temperature
- name the keratinase that has the widest working range of pH.

Table 2.1

keratinase	temperature range with at least 60% relative activity / °C	pH range with at least 60% relative activity
K12	41–63	
A22		6.0–9.0
P3	29–56	5.3–7.5

Keratinase with a relative activity of at least 60% that has:

- the widest working range of temperature
- the widest working range of pH

[4]

(e) Some detergents contain proteases to remove stains from clothes. These enzymes have a high relative activity in alkaline conditions.

The scientists reported that K12 and A22 could be suitable for use in the detergent industry.

With reference to Fig. 2.1 and Fig. 2.2, discuss the advantages **and** disadvantages of using K12 and A22 in the detergent industry.

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..... [3]

Question No 19 - (9700_w23_22_3)
Subsection Topics: (a) : 8.1 - The circulatory system | (b) : 4.2 - Movement into and out of cells, 11.1 - The immune system | (c) : 1.2 - Cells as the basic units of living organisms, 6.2 - Protein synthesis, 2.3 - Proteins

The liver receives blood from the hepatic artery and from the hepatic portal vein. The hepatic portal vein transports blood from the digestive system.

Hepatocytes are the main cell type of the liver. They have a wide range of functions, including:

- the synthesis of triglycerides and plasma proteins
- detoxifying waste
- energy storage.

(a) The hepatic artery branches from the main artery that transports blood from the heart.

Name the main artery that transports blood to the hepatic artery.
..... [1]

(b) Blood arriving at the liver enters specialised blood vessels known as sinusoids.

Fig. 3.1 is a diagram of part of a sinusoid and surrounding hepatocytes. A second type of cell found in the liver, a Kupffer cell, is also shown.

Kupffer cells are phagocytic cells of the immune system.

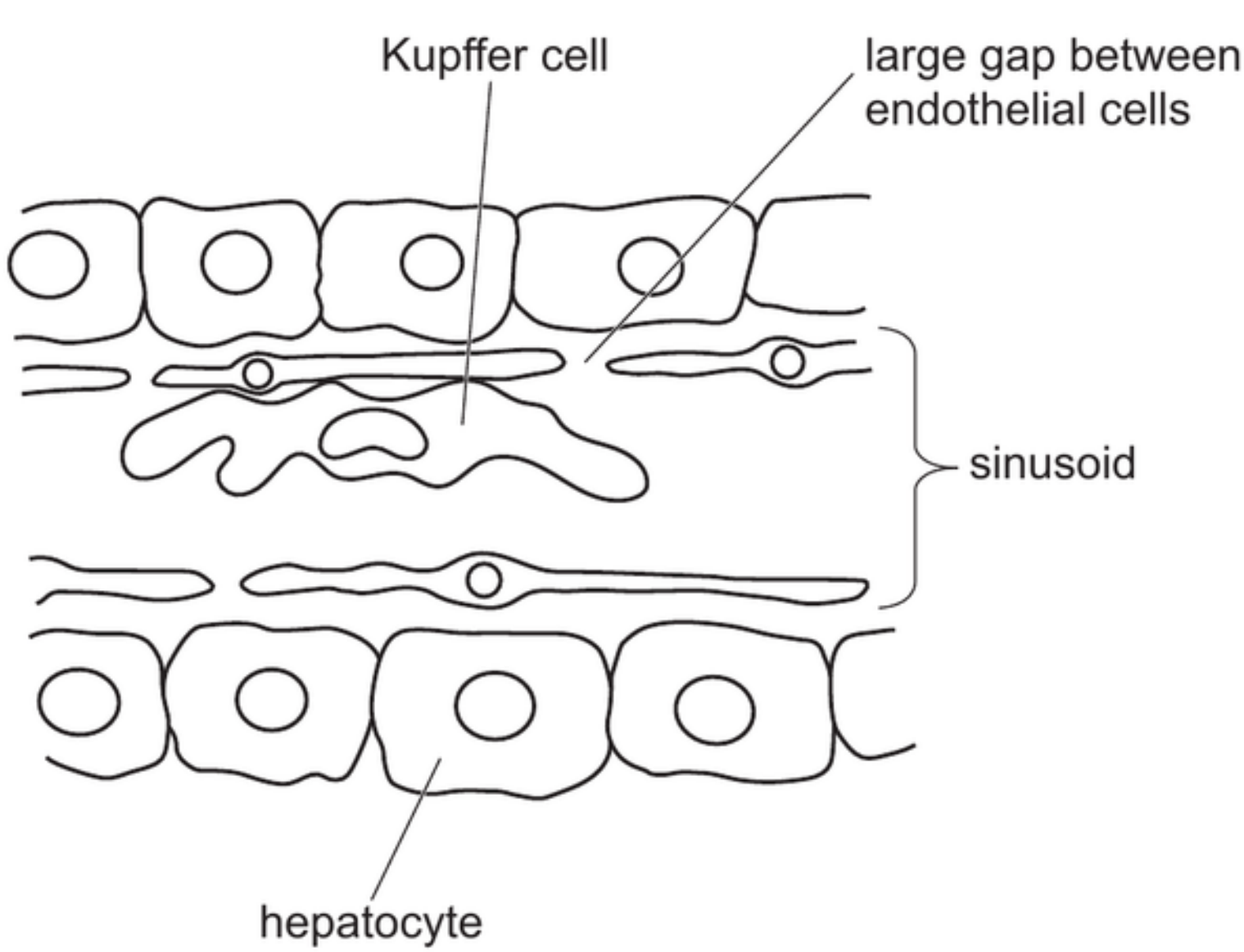


Fig. 3.1

(i) Suggest **one** advantage of having large gaps between the endothelial cells of the sinusoid, as shown in Fig. 3.1.

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..... [1]

(ii) In addition to removing bacteria present in the blood inside the sinusoid, Kupffer cells are also able to remove old or damaged red blood cells.

Describe the mode of action of a Kupffer cell in removing and breaking down a damaged red blood cell.

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..... [4]

(c) Fig. 3.2 is a transmission electron micrograph of part of a hepatocyte showing some cell structures.

The peroxisome shown in Fig. 3.2 is a spherical organelle bound by a single membrane. It carries out a variety of enzyme-catalysed metabolic reactions, including detoxification. Some of these reactions require oxygen.



Fig. 3.2

(i) Describe the evidence **visible** in Fig. 3.2, apart from the presence of a peroxisome, that indicates some of the functions of a hepatocyte.

Add labels to Fig. 3.2 to identify the location of any cell structures, if not already labelled, that are part of your evidence.

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..... [3]

(ii) The mitochondria in Fig. 3.2 are larger than the peroxisome.

State **one other** difference, **visible** in Fig. 3.2, between a peroxisome and a mitochondrion.

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..... [1]

(iii) Some of the enzymes used within mitochondria can be synthesised by the organelle. Peroxisomes cannot synthesise any of the enzymes that they contain.

Suggest why a mitochondrion can synthesise enzymes, but a peroxisome cannot synthesise enzymes.

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..... [2]

(iv) One of the enzymes present in peroxisomes is catalase. This enzyme catalyses the breakdown of hydrogen peroxide to harmless products.

Suggest why it is useful to the cell for this reaction to take place within peroxisomes.

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..... [2]

Question No 20 - (9700_w23_23_5)

Subsection Topics: (c) : 7.1 - Structure of transport tissues | (a) : 7.2 - Transport mechanisms | (b) : 7.2 - Transport mechanisms

In flowering plants, transport of assimilates occurs in phloem tissue between sources and sinks.

(a) (i) Explain why a root can be a source **and** a sink.

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..... [2]

(ii) State **two** examples of assimilates that are transported in the phloem.

..... [1]

(b) Describe **and** explain the mechanism that is responsible for the movement of phloem sap in sieve tubes.

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..... [4]

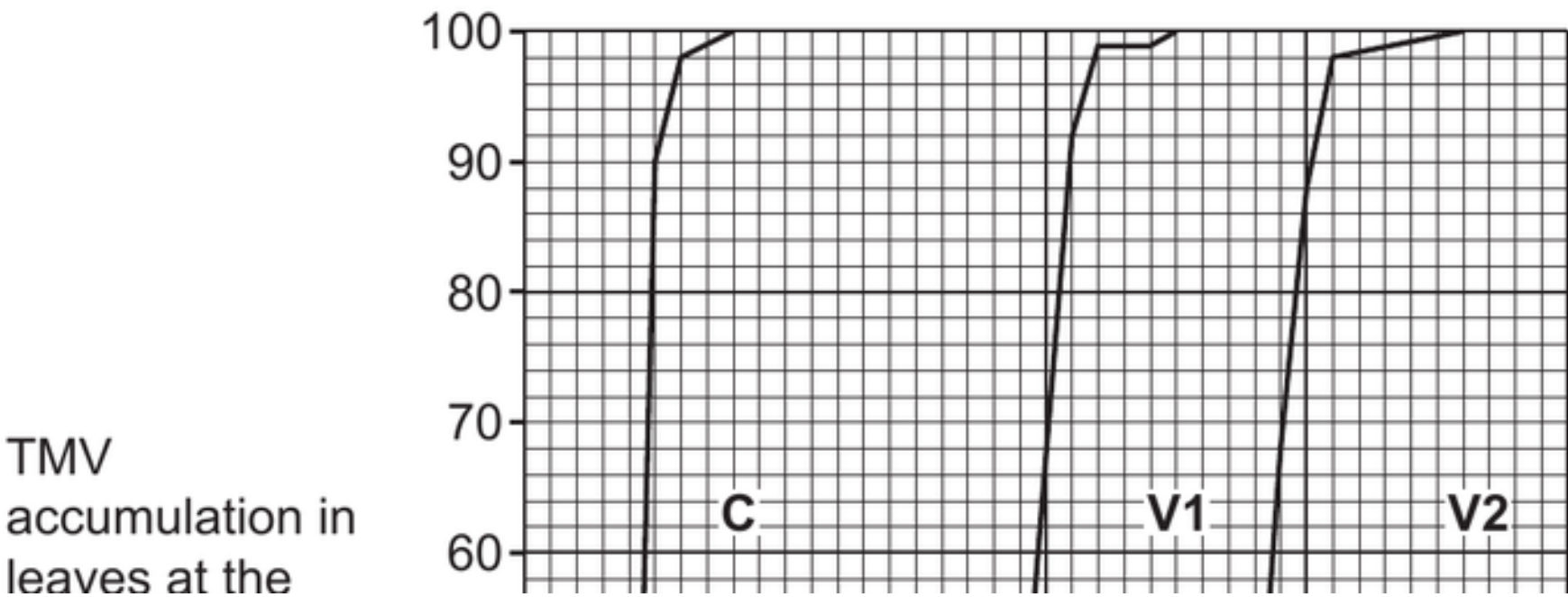
(c) Tobacco mosaic virus (TMV) infects many crop plants. The virus passes between cells in the leaves and can travel throughout plants in the phloem.

The enzyme pectin methylesterase (PME) is involved with the production of cell walls. The enzyme is also known to influence the movement of TMV through plants. Scientists investigated the effect of PME on the transport of TMV through plants.

The scientists used three varieties of tobacco plants. Two varieties, **V1** and **V2**, have small quantities of PME. A third variety, **C**, has the normal quantity of PME and was used as the control in this investigation.

The plants in each group were infected with TMV at the same time. The accumulation of the virus particles transported to the leaves at the top of the plants was determined over 36 days.

The results are shown in Fig. 5.1. The arrow indicates when all the plants were infected with TMV.



top of the plants
/ percentage of
maximum number
of virus particles
in control plants

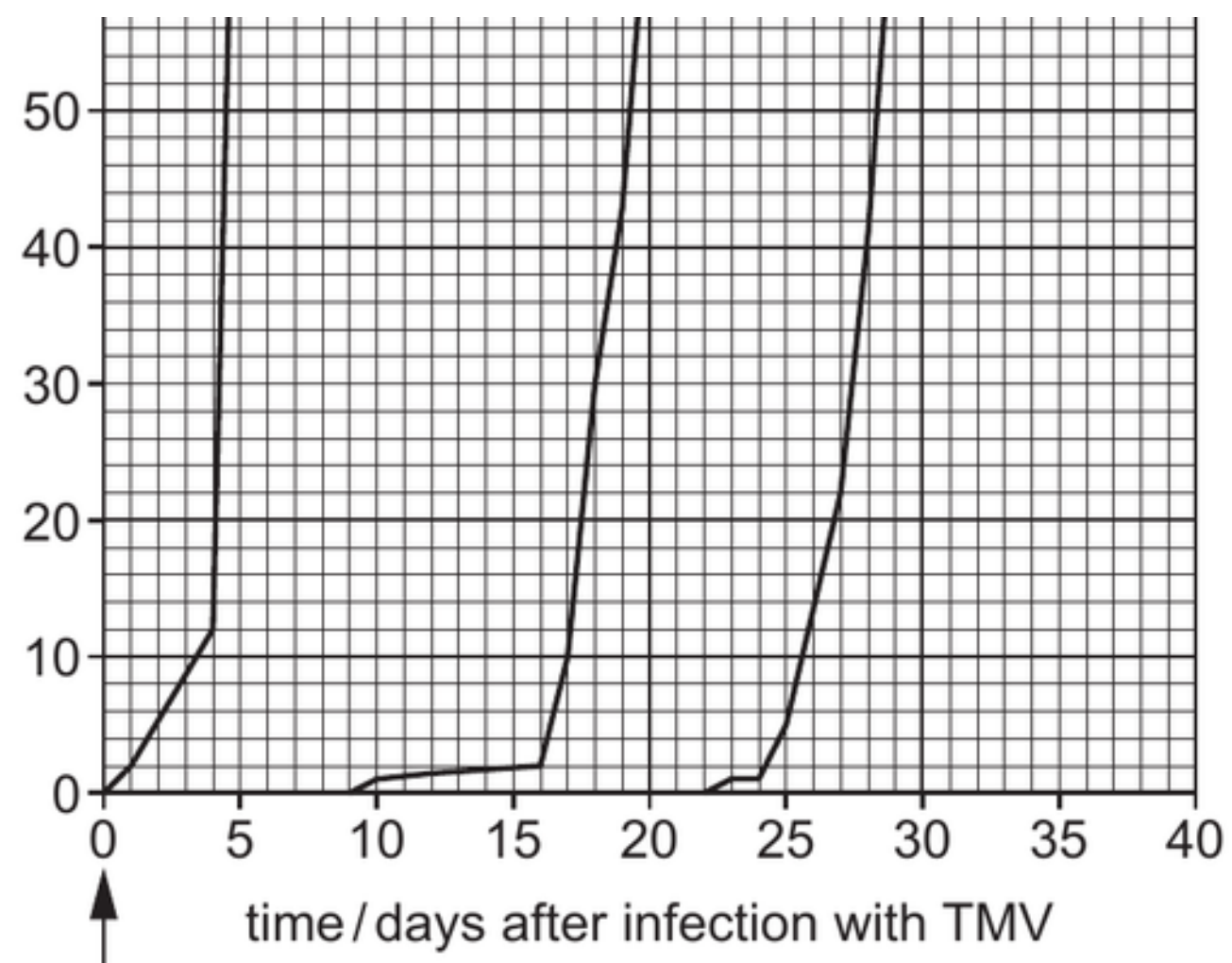


Fig. 5.1

Compare the results for varieties **V1** and **V2** with the control group of plants, **C**.

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..... [3]

Question No 21 - (9700_m22_22_1)

Subsection Topics: (a) : 4.2 - Movement into and out of cells | (b) : 7.2 - Transport mechanisms | (c) : 7.2 - Transport mechanisms

(a) Table 1.1 shows three of the processes by which substances in solution can move across cell membranes. It also lists five statements that may apply to each of these three processes.

Complete Table 1.1 to show which of the statements apply to each of the three processes shown.

Use a tick (✓) to show that the statement applies or a cross (X) to show that the statement does not apply.

Each box must contain a tick or a cross.

The first row has been completed for you.

Table 1.1

statement	process		
	active transport	facilitated diffusion	simple diffusion
movement of oxygen into a red blood cell	X	X	✓
occurs in both animal and plant cells			
uses carrier proteins			
movement of non-polar molecules between the fatty acid tails of the phospholipid molecules			
movement of ions down a concentration gradient			

[4]

(b) Fig. 1.1 is a simplified diagram representing a transverse section of part of a young root. The diagram is not to scale.

(i) On Fig. 1.1 draw a label line and label with the letter **C** to identify the Casparian strip. [1]

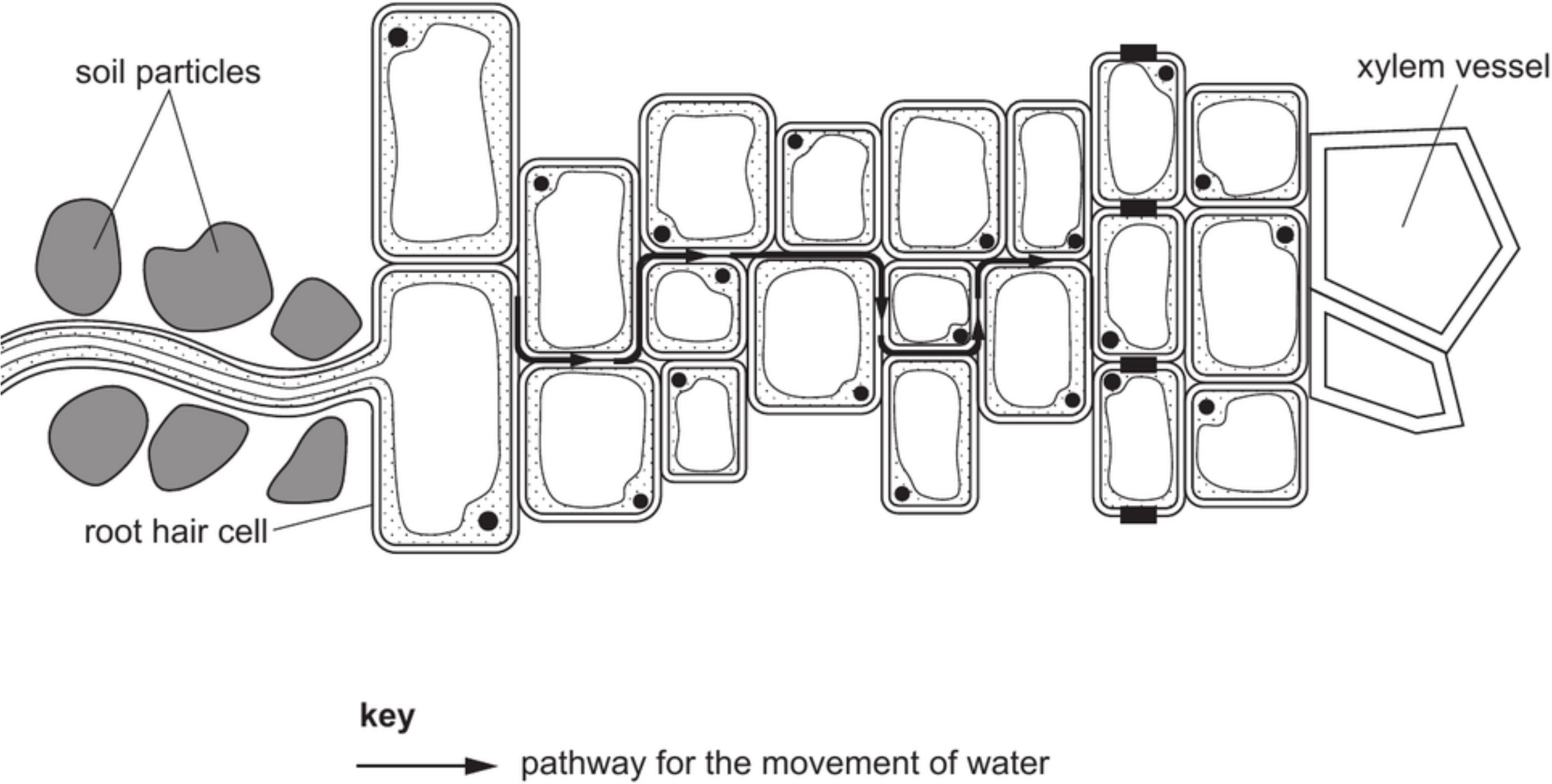


Fig. 1.1

(ii) Root hairs measure approximately 5µm in diameter and 500µm in length.

Explain how this adapts root hairs for the absorption of water.

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..... [1]

(iii) Name the pathway for the movement of water shown by the arrows in Fig. 1.1.

..... [1]

(c) Water enters the xylem vessels shown in Fig. 1.1.

Explain how water moves up the xylem vessels to the leaves in a continuous column.

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..... [3]

Question No 22 - (9700_s22_21_6)

Subsection Topics: (a) : 6.1 - Structure of nucleic acids and replication of DNA | (b) : 6.1 - Structure of nucleic acids and replication of DNA | (c) : 6.2 - Protein synthesis

Cotransporter proteins are membrane proteins found in companion cells of phloem tissue.

Messenger RNA (mRNA) is the molecule in cells that carries genetic information in the DNA that codes for cotransporter proteins to the sites of protein synthesis in the cytoplasm.

(a) Complete Table 6.1 to compare the structure of a molecule of mRNA with the structure of a molecule of DNA.

Table 6.1

feature	mRNA	DNA
names of four bases		
name of pentose sugar present		
number of strands		

[3]

(b) Fig. 6.1 shows the events that occur in the nucleus of a companion cell in phloem tissue to synthesise molecules of mRNA.

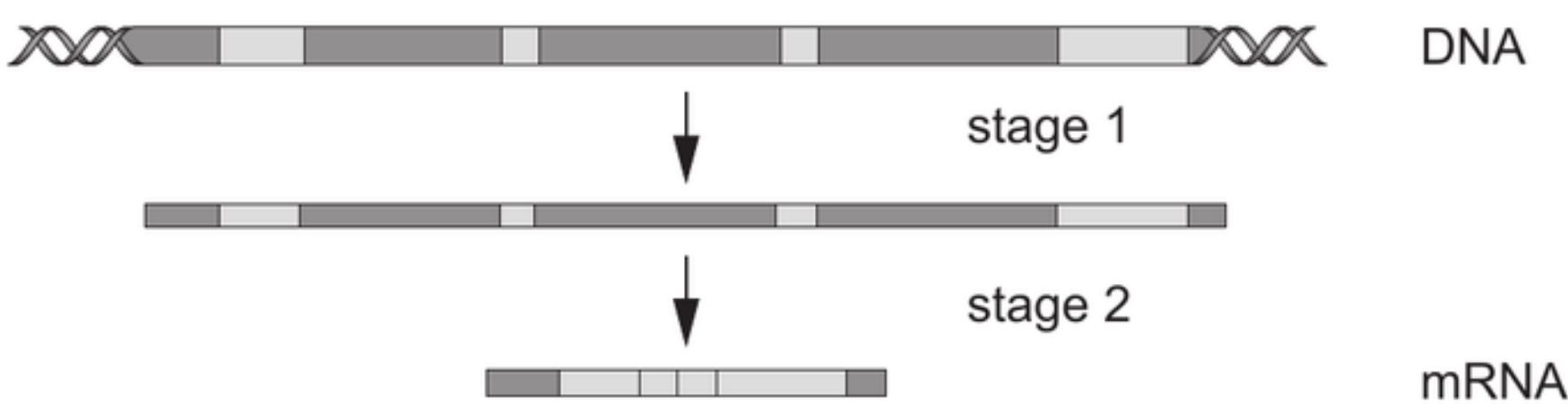


Fig. 6.1

- (i) Name stage 1 shown in Fig. 6.1.
- [1]
- (ii) Describe what happens at stage 2, shown in Fig. 6.1, to shorten the length of the RNA molecule.
-
-
-
-
- [2]

(c) Cotransporter molecules are proteins produced in companion cells.

Fig. 6.2 shows what happens in the cytoplasm of a companion cell to a transfer RNA molecule before the cotransporter proteins can be produced.

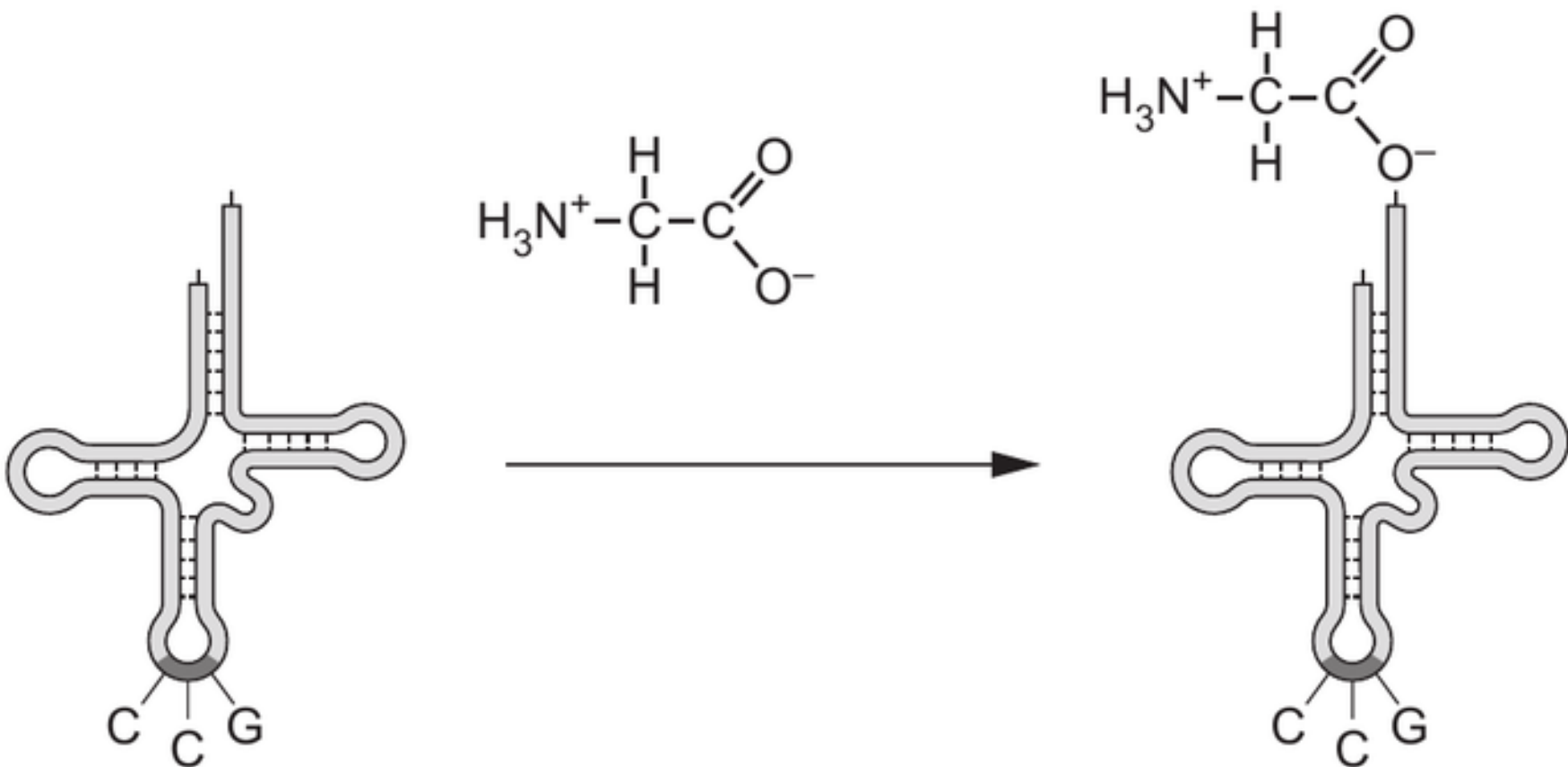


Fig. 6.2

- (i) Describe the role of the transfer RNA shown in Fig. 6.2 in the synthesis of a cotransporter protein.
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..... [4]

- -

(ii) Outline the role of cotransporter proteins in companion cells.

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..... [3]

[Total: 13]

Question No 23 - (9700_s22_22_6)

Subsection Topics: (a) : 7.2 - Transport mechanisms | (b) : 7.2 - Transport mechanisms

The transport tissues of plants are phloem and xylem.

The role of xylem is the transport of water and mineral ions from the soil solution to the different parts of the plant body.

The role of phloem is the translocation of assimilates and other substances from sources to sinks.

- (a)** The source of mineral ions for the plant is the soil solution. These mineral ions are transported from the roots in the xylem. Mineral ions are also found in the phloem sap within phloem sieve tubes.

Suggest why mineral ions are found within phloem sieve tubes **and** state how they are transported within phloem sieve tubes.

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..... [3]

- (b)** Phloem tissue consists of different cell types.

Complete the passage using the most appropriate terms to summarise some of the features of phloem tissue.

The end walls of sieve tube elements are modified to allow efficient flow of phloem sap by the formation of These structures also prevent the cells from bursting under pressure. The cytoplasm of sieve tube elements is very much reduced and is found at the of the cells. Most of the organelles in the cell are absent. Adjacent to sieve tube elements are cells that carry out the metabolic processes of the missing organelles, allowing the sieve tube elements to function. [3]

Question No 24 - (9700_s22_22_4)

Subsection Topics: (a) : 8.2 - Transport of oxygen and carbon dioxide | (b) : 3.1 - Mode of action of enzymes
| (c) : 6.1 - Structure of nucleic acids and replication of DNA | (d) : 8.2 - Transport of oxygen and carbon
dioxide | (e) : 7.2 - Transport mechanisms | (f) : 3.2 - Factors that affect enzyme action

The enzyme carbonic anhydrase has been found in a wide range of organisms and acts as a catalyst in many tissues.

Studies have shown that there are differences in the protein structure of the enzyme and differences in the number and organisation of introns and exons of the gene coding for the enzyme.

All carbonic anhydrase enzymes catalyse the same reversible reaction, shown in Fig. 4.1.

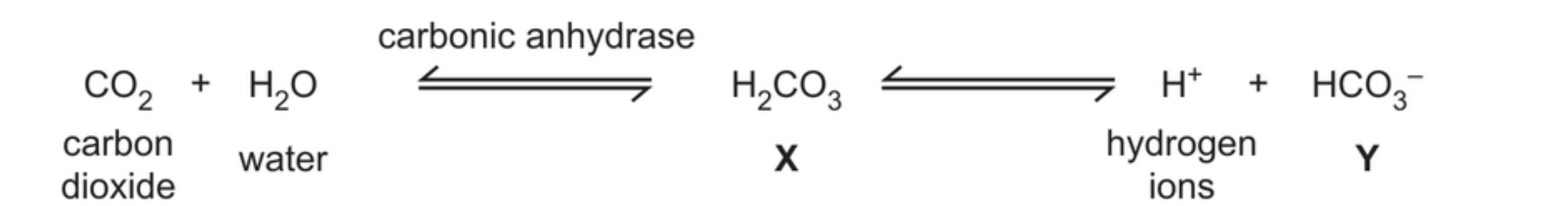


Fig. 4.1

(a) With reference to Fig. 4.1, name X and Y.

X

Y [2]

(b) Carbonic anhydrase enzymes can have different primary structures.

Suggest how all carbonic anhydrase enzymes can catalyse the same reaction, even though they have different primary structures.

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..... [1]

(c) Genes coding for proteins in eukaryotes consist of introns and exons.

Outline the similarities and differences between the introns and the exons of genes coding for proteins such as carbonic anhydrase.

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..... [3]

All mammals have the same type of carbonic anhydrase, known as α -carbonic anhydrase. Many different forms, or isoforms, of α -carbonic anhydrase have been identified in mammals.

There are 15 isoforms of α -carbonic anhydrase (CA) in humans. Cells of different tissues have one or more isoforms. Within cells the isoforms may be in different locations.

(d) Red blood cells contain two isoforms, CA1 and CA2.

Suggest the location of CA1 and CA2 in red blood cells **and** give a reason for your answer.

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..... [2]

(e) Isoform CA6 forms part of human breast milk. Mammary gland cells package CA6 in Golgi vesicles for release from the cells.

Name the transport mechanism associated with CA6 secretion.

..... [1]

- (f) Human CA isoforms in some epithelial cells in the eye have a role in the formation of the clear fluid of the eye known as aqueous humour. Overactivity of the enzyme may lead to a harmful increase of pressure within the eye and cause a condition known as glaucoma.

Acetazolamide is a therapeutic drug that can be used in the treatment of glaucoma. It acts as a reversible non-competitive inhibitor.

Describe the mechanism of action of acetazolamide as a reversible non-competitive inhibitor of carbonic anhydrase.

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..... [3]

[Total: 12]

Question No 25 - (9700_s22_23_3)

Subsection Topics: (a) : 2.2 - Carbohydrates and lipids | (b) : 5.1 - Replication and division of nuclei and cells

Hakea spp. are xerophytic plants native to Australia. The leaves of *Hakea* have adaptations for a xerophytic mode of life.

(a) Fig. 3.1 is a photomicrograph of a transverse section of part of a leaf of *H. laurina*.

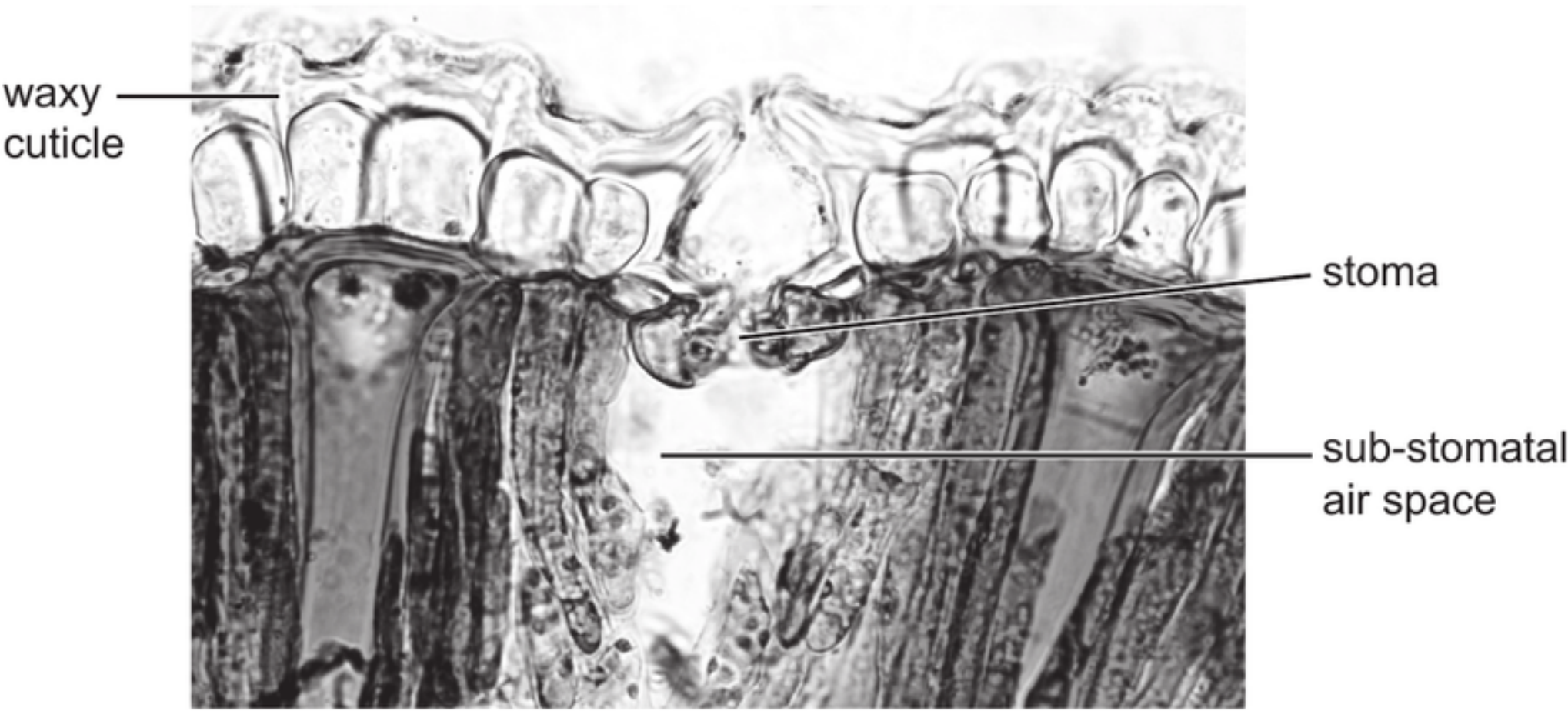


Fig. 3.1

Describe the xerophytic features of the waxy cuticle and the stoma shown in Fig. 3.1 **and** explain how these features adapt the plant to a xerophytic mode of life.

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..... [3]

(b) When the availability of phosphate ions and other soil nutrients is limited, a number of changes occur in the roots of *Hakea* spp.:

- Regions of meristematic tissue are active for a few days.
- Root clusters are formed. A root cluster is a dense arrangement of tiny side roots known as rootlets.
- Most of the epidermal cells of the rootlets are root hair cells.
- Rootlets release compounds into the soil that make phosphates and other mineral ions more soluble for uptake.
- Uptake of phosphate ions and the absorption of water from the soil increases.

(i) Meristem cells have a similar role to stem cells in animals.

Suggest how meristematic tissue activity leads to the formation of root clusters.

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..... [3]

(ii) Organic anions (negatively charged organic compounds) are released into the soil by rootlets. The concentration of these organic anions can become higher in the soil solution than in the rootlet cells.

Suggest **and** explain how the concentration of organic anions in the soil solution can

become higher than in the rootlet cells.

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..... [3]

(iii) Explain how the formation of root clusters can lead to an increase in the uptake of phosphate ions and absorption of water from the soil solution.

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..... [2]

Question No 26 - (9700_w22_21_5)
Subsection Topics: (a) : 7.2 - Transport mechanisms | (b) : 7.1 - Structure of transport tissues | (c) : 1.2 - Cells as the basic units of living organisms | (d) : 10.1 - Infectious diseases

(a) When water molecules enter a plant through the roots, the molecules cross the cortex and enter the xylem tissue to be transported to other parts of the plant.

There are two pathways that water can take when crossing the root to the xylem tissue.

Complete Table 5.1 with information about the two pathways.

Table 5.1

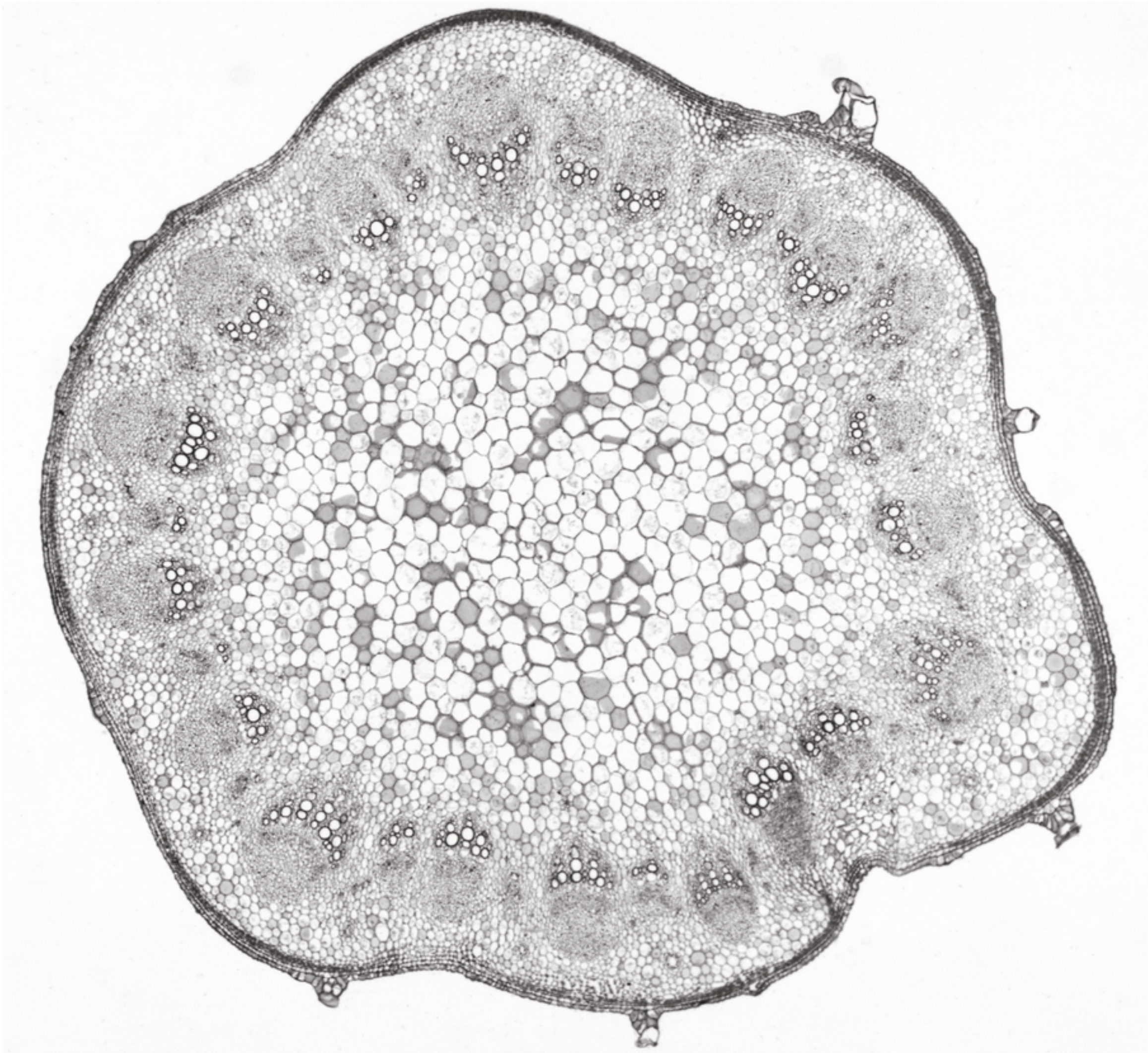
name of pathway	outline of pathway
	movement of water from cell to cell through plasmodesmata

[2]

(b) Fig. 5.1 is a photomicrograph of a transverse section through the stem of a flowering plant.

On Fig. 5.1, draw a label line and the letter **T** to identify xylem tissue.

[1]



(c) Scientists have studied the process of cell death that occurs during the development of the cells that become mature xylem vessel elements.

During this development, the tonoplast ruptures (bursts) and releases hydrolytic enzymes contained in the vacuole into the cytoplasm.

(i) Name an organelle found in animal cells that has a similar function to the vacuole in the developing xylem vessel elements.

..... [1]

(ii) The rupture of the tonoplast during development of xylem vessel elements is due to changes in permeability of the tonoplast.

Suggest how the permeability of the tonoplast changes **and** explain how this change could result in the rupture of the tonoplast.

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..... [3]

(iii) During development of the xylem vessel elements the pH of the cytoplasm decreases. This change in pH activates enzymes in the cytoplasm that cause organelles to swell.

Suggest how a change in pH of the cytoplasm can activate enzymes.

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..... [2]

(d) Some insects are vectors of disease.

- (i) When an insect feeds on the xylem fluid it can act as a vector of plant diseases such as Pierce’s disease. This bacterial disease affects many fruit trees causing the leaves to turn brown and drop from the plant, resulting in much less fruit being produced.

Explain why Pierce’s disease can be described as an infectious disease.

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..... [2]

- (ii) Malaria is another infectious disease that also involves an insect vector.

State the type of organism that causes malaria **and** name **one** organism that causes malaria in humans.

type of organism

name [2]

Question No 27 - (9700_w22_22_6)

Subsection Topics: (a) : 7.2 - Transport mechanisms | (b) : 7.2 - Transport mechanisms

Xylem and phloem are the transport tissues of plants. Both tissues have more than one cell type.

The conducting cells of xylem contain xylem sap and those of phloem contain phloem sap.
The composition of xylem sap differs from the composition of phloem sap.

(a) The main component of xylem sap and phloem sap is water.

Explain why water is the main component of xylem sap and phloem sap.

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..... [2]

(b) Three types of cell associated with the translocation of sucrose are:

- companion cell
- mesophyll cell
- phloem sieve tube element.

A, B and C are three events that occur at the source. Each event refers to ‘the cell’ but does not name the type of cell concerned.

- A Sucrose moves through plasmodesmata into the cell.
- B Hydrogen ions are transported out of the cell.
- C Sucrose moves into the cell through cotransporter proteins.

Complete Table 6.1 by matching the event with a correct cell type.

Each cell type may be identified once, more than once, or not at all.

Table 6.1

event	cell type
A	
B	
C	

[3]

[Total: 5]

Question No 28 - (9700_w22_22_4)

Subsection Topics: (a) : 9.1 - The gas exchange system | (b) : 9.1 - The gas exchange system

The airways of the gas exchange system are lined with epithelium. Gradual changes in the structural features of this epithelium occur as the airways branch and become increasingly narrow.

(a) Table 4.1 shows the changes that occur in the number of goblet cells in the epithelium of the different structures of the gas exchange system.

Table 4.1

gas exchange structure	number of goblet cells in epithelium
trachea	many
bronchi	many
larger bronchioles	very few
smaller bronchioles	none
alveoli	none

Goblet cells produce mucus, which is important in maintaining the health of the airways.

The smallest bronchioles closest to the alveoli are known as respiratory bronchioles.

Suggest **and** explain why respiratory bronchioles do not have any goblet cells.

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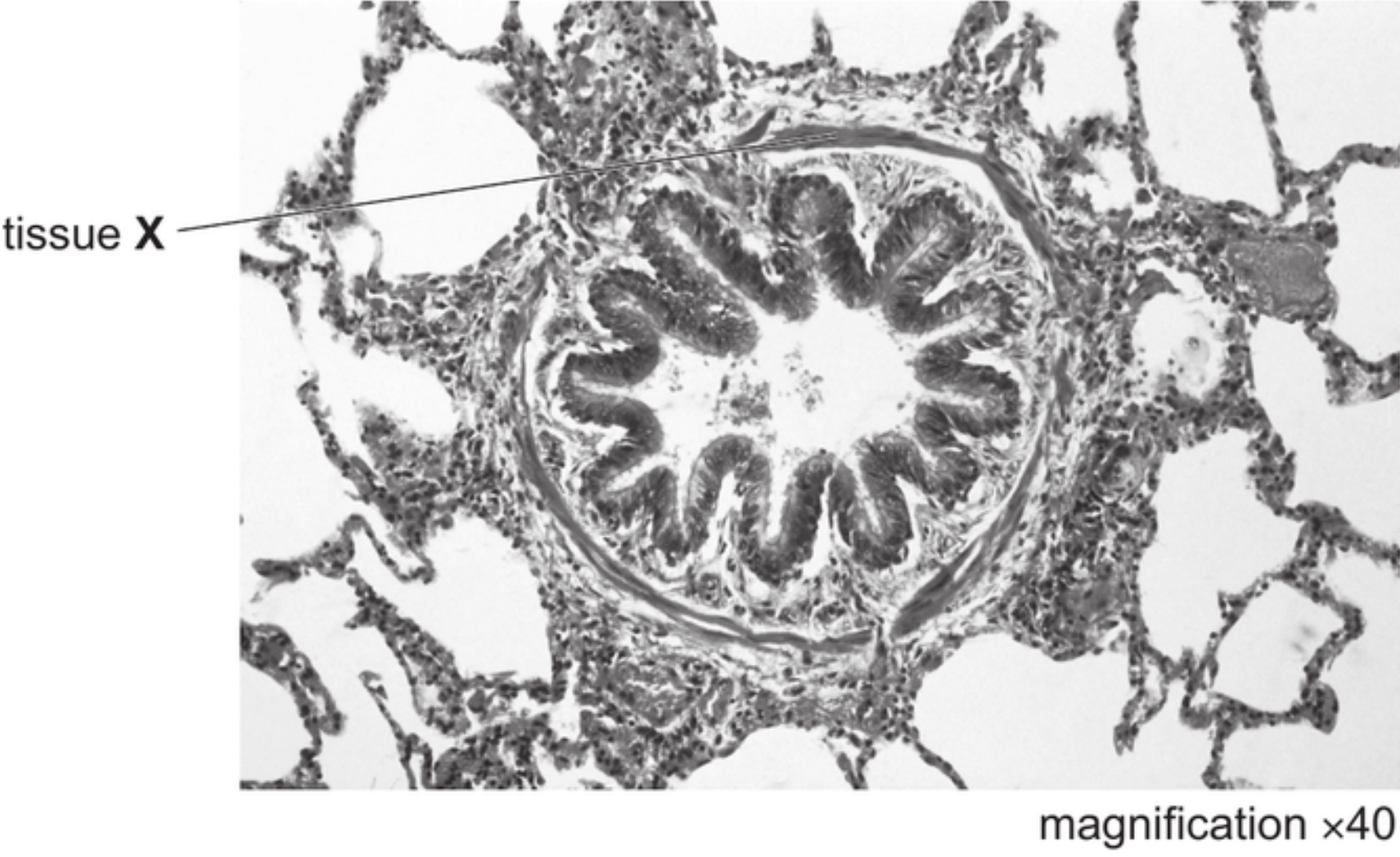
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..... [2]

(b) Fig. 4.1 is a photomicrograph of a section through a bronchiole, which is surrounded by alveoli.



(i) There are structural differences between the epithelium of the bronchiole and the epithelium of an alveolus.

Describe the differences between the epithelium of bronchioles and the epithelium of alveoli, **other than** differences in the number of goblet cells.

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..... [3]

(ii) Tissue **X**, shown in Fig. 4.1, is located in the wall of the bronchiole.

Name tissue **X and** outline the function of tissue **X** in the bronchiole.

tissue **X** =

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..... [3]

[Total: 8]

Question No 29 - (9700_w22_23_3)

Subsection Topics: (a) : 7.2 - Transport mechanisms | (b) : 7.2 - Transport mechanisms

(a) Explain how water moves up xylem vessels in the trunks of trees.

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..... [4]

(b) Cavitation is the formation of air-filled spaces inside the columns of water in xylem vessels in trees. These air-filled spaces form more often when there are high rates of movement of water in xylem vessels.

When an air-filled space forms in a xylem vessel, a noise is made that can be detected as a ‘click’ by a sensor placed close to the xylem vessels in the trunk of a tree.

Students investigated the relationship between two environmental factors and the rate of cavitation in a Scots pine tree, *Pinus sylvestris*, over a 50-hour period. The two factors they investigated were:

- photosynthetically active radiation (PAR), which is the light energy available to plants that they absorb and use in photosynthesis
- wind speed.

The cavitation rate was estimated by recording the number of clicks detected by the sensor. The results are shown in Fig. 3.1.

Suggest the conclusions that can be made with reference to the data in Fig. 3.1.

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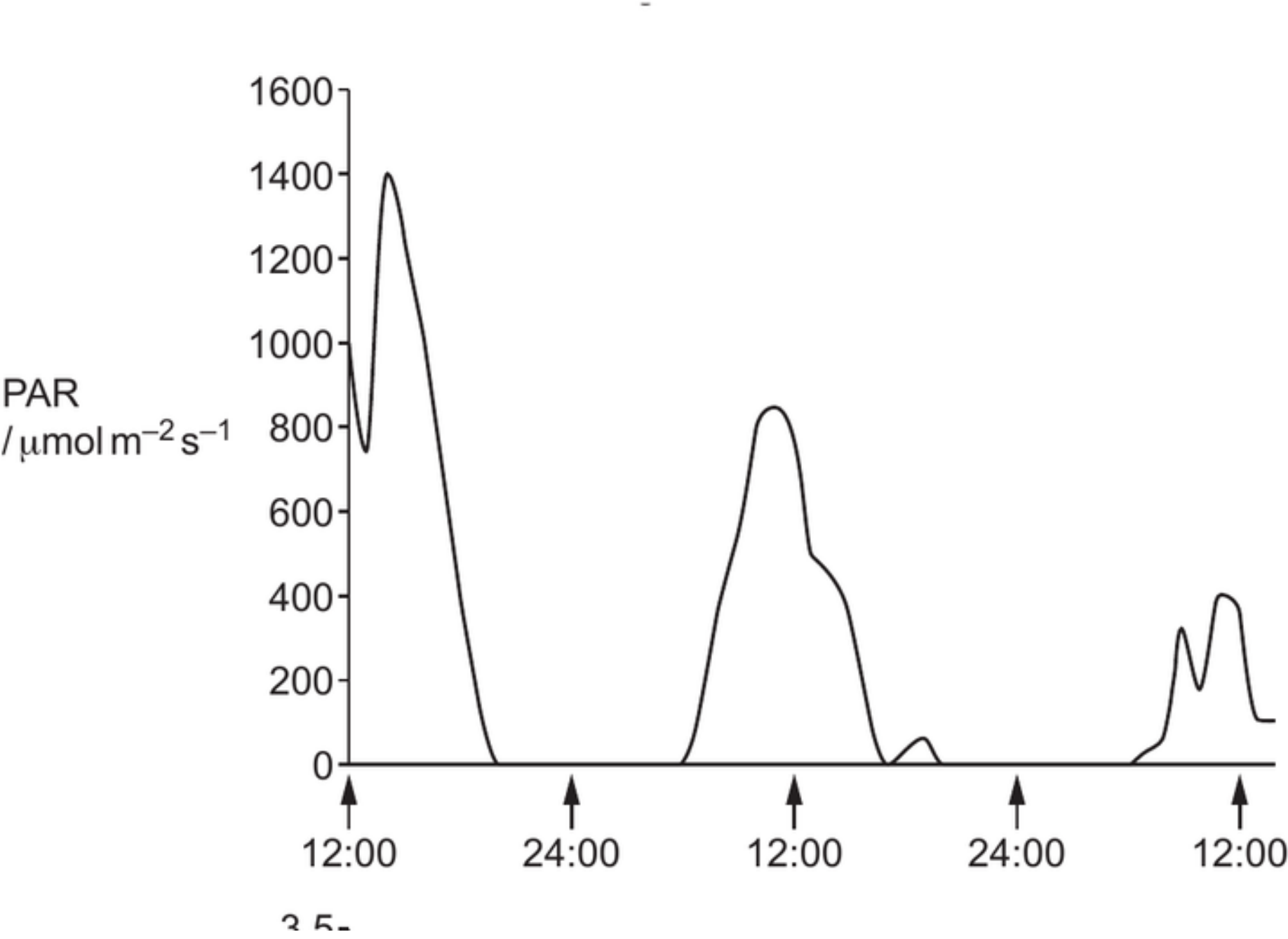
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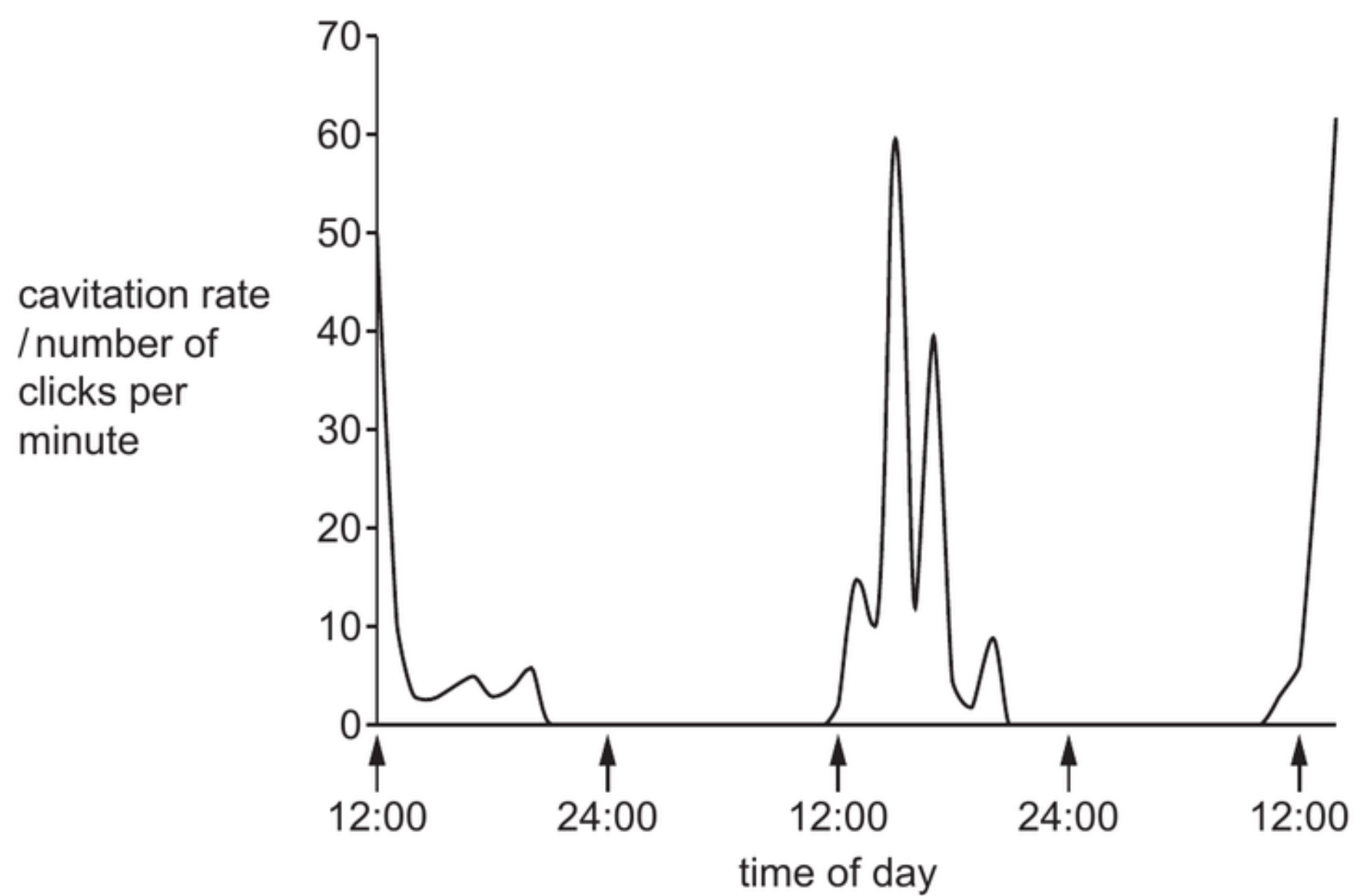
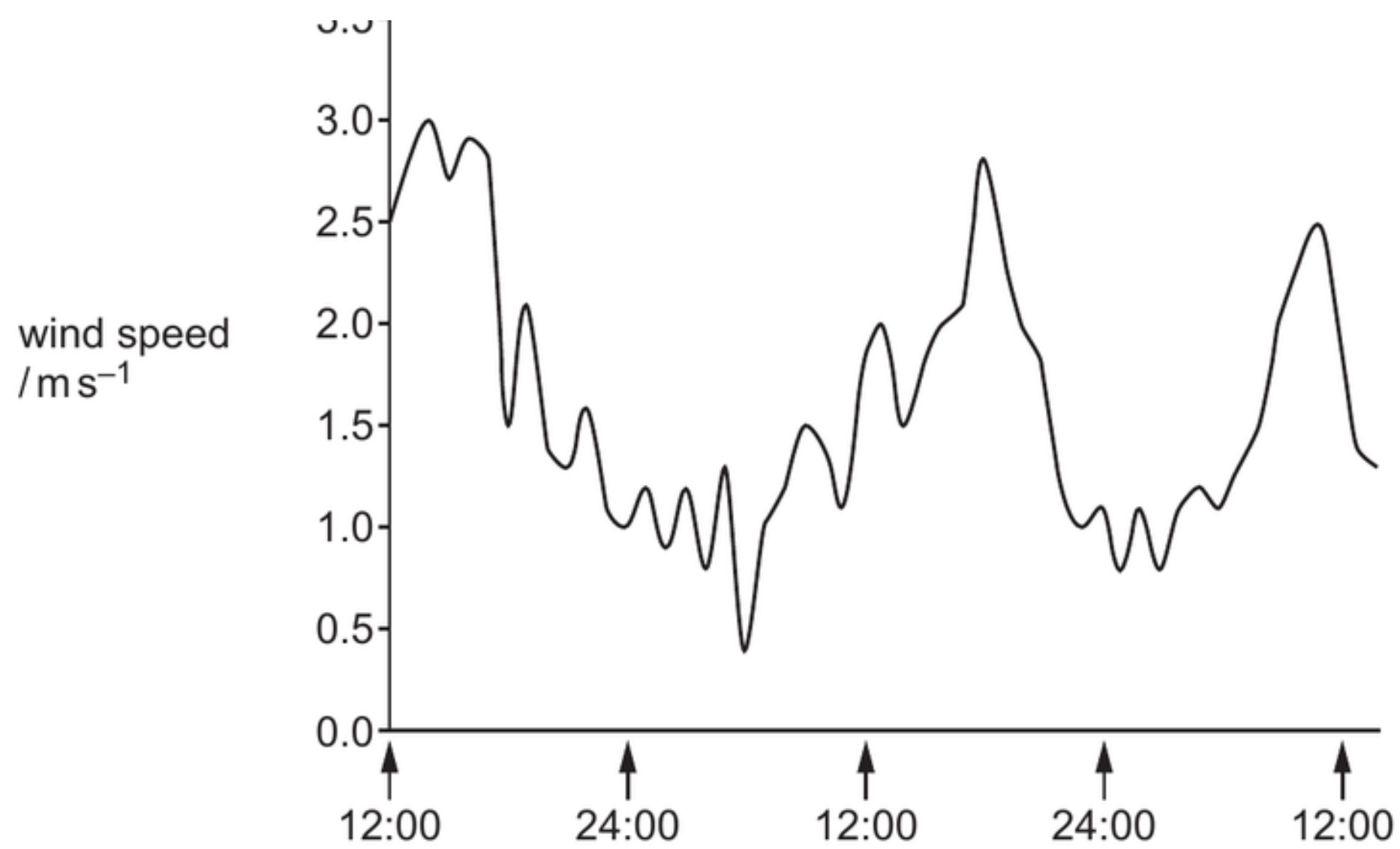
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..... [3]

[Total: 7]





Cathelicidin LL-37 is a cell signalling compound that stimulates many different cells in humans. One role of cathelicidin LL-37 is stimulating the production of endothelial cells in the formation of capillaries during wound healing.

- (a)

(i)

Explain how it is possible for many different cell types to respond to the same cell signalling compound.

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.....

..... [2]

(ii)

Describe the appearance of the endothelial cells of a capillary.

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..... [2]

Cathelicidin LL-37 is a protein composed of 37 amino acids.

Table 5.1 shows:

- the sequence of the first 10 amino acids in the primary structure of cathelicidin LL-37
- DNA triplets in the non-transcribed strand in the gene that codes for the first 10 amino acids in the primary structure of cathelicidin LL-37.

Table 5.1										
amino acid position	1	2	3	4	5	6	7	8	9	10
amino acid	leu	leu	gly	asp	phe	phe	arg	lys	ser	lys
DNA triplet	CTG	CTG	GGT	GAT	TTC	TTC	CGG	AAA	TCT	AAA

Table 5.2 shows the triplets of bases in **DNA** and the amino acids for which they code.

Table 5.2										
second base										
first base			T		C		A		G	
		T	TTT	phe	TCT	ser	TAT	tyr	TGT	T
			TTC		TCC		TAC		TGC	C
			TTA	leu	TCA		TAA	stop	TGA	A
			TTG		TCG		TAG		TGG	G
		C	CTT	leu	CCT	pro	CAT	his	CGT	T
			CTC		CCC		CAC		CGC	C
			CTA		CCA		CAA	gln	CGA	A
			CTG		CCG		CAG		CGG	G
		A	ATT	ile	ACT	thr	AAT	asp	AGT	T
			ATC		ACC		AAC		AGC	C
			ATA	ile	ACA		AAA	lys	AGA	A
			ATG	met	ACG		AAG		AGG	G
		G	GTT	val	GCT	ala	GAT	asp	GGT	T
			GTC		GCC		GAC		GGC	C
			GTA		GCA		GAA	glu	GGA	A
			GTG		GCG		GAG		GGG	G
										third base

- (b)

Mutations of DNA base sequences in a gene can affect the primary structure of proteins.

Use the information in Table 5.1 and Table 5.2 to suggest the effect on the primary structure of cathelicidin LL-37 of:

(i)

the substitution of the base T with the base A in the middle of the triplet at position 5

..... [1]

(ii)

the deletion of base T in the triplet at position 2

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.....
..... [2]

(iii) the insertion of base G between bases G and T in the triplet at position 3.

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.....
..... [2]

(c) The genetic code is described as universal.

Explain why the genetic code is described as universal.

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.....
..... [1]

(d) Use Table 5.2 to explain why some mutations have no effect on the primary structure of a protein.

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..... [2]

Question No 31 - (9700_m21_22_5)

Subsection Topics: (a) : 5.1 - Replication and division of nuclei and cells | (b) : 7.2 - Transport mechanisms

Each meristem cell in a leaf bud is able to grow and divide by mitosis to produce two daughter cells that are genetically identical to each other and to the original dividing cell.

(a) Fig. 5.1 lists the stages in the mitotic cell cycle of a meristem cell.

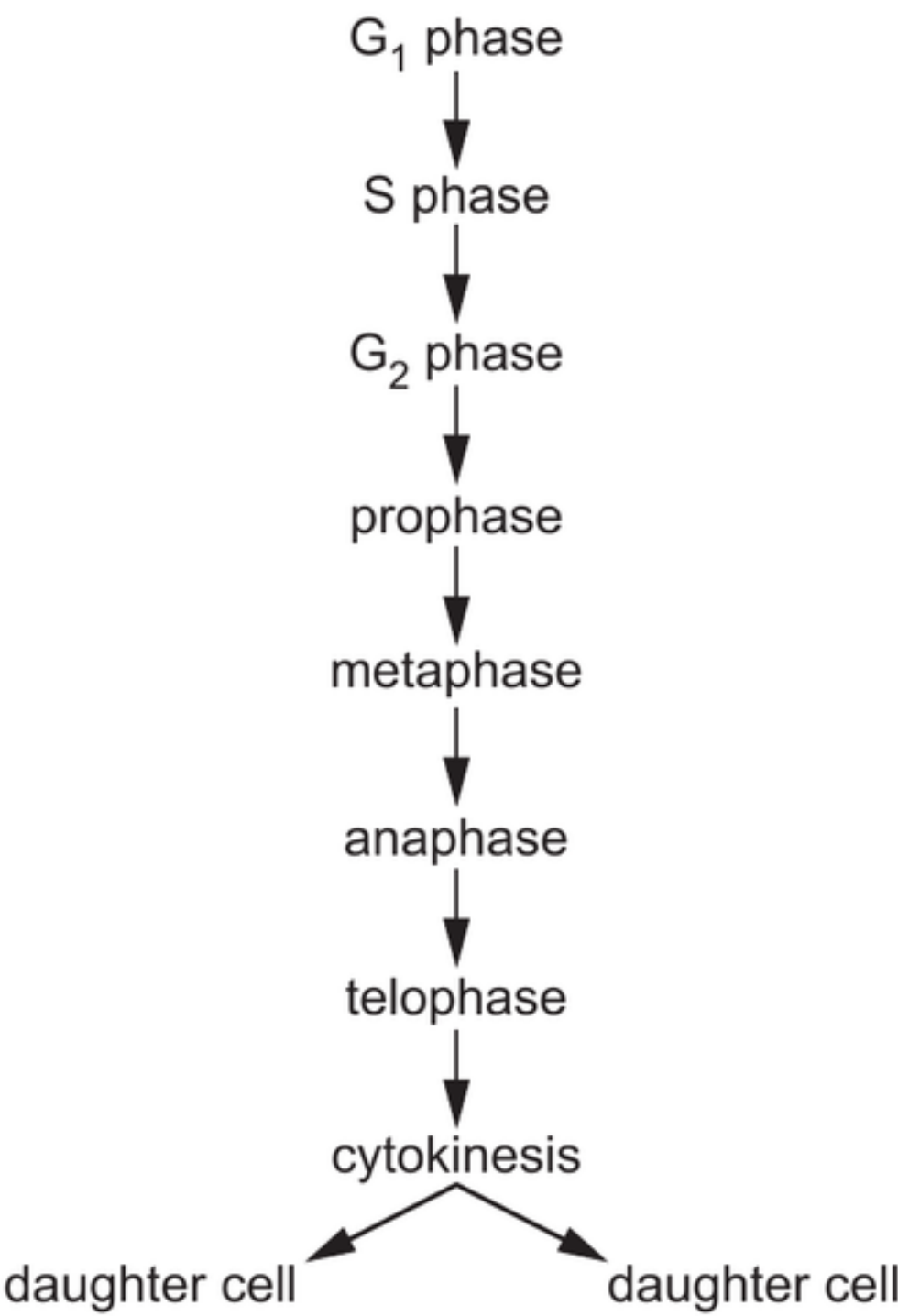


Fig. 5.1

(i) Outline **and** explain the events occurring during S phase, metaphase and anaphase of the mitotic cell cycle that are important in the production of genetically identical daughter cells.

S phase

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metaphase

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anaphase

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[1]

(ii) Immediately after cytokinesis, daughter cells are **not** identical even though they are genetically identical.

Suggest a reason why daughter cells are **not** identical immediately after cytokinesis.

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..... [1]

(b) Some of the cells resulting from mitotic division in the young leaf form elongated cells that develop into xylem vessel elements. The xylem vessel elements are joined end to end to form xylem vessels.

(i) Suggest the structural changes that occur when elongated cells develop into xylem vessel elements **and** explain how these changes help xylem vessels to perform their function in transport.

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..... [4]

(ii) Fig. 5.2 is a plan diagram of a transverse section through a dicotyledonous leaf.

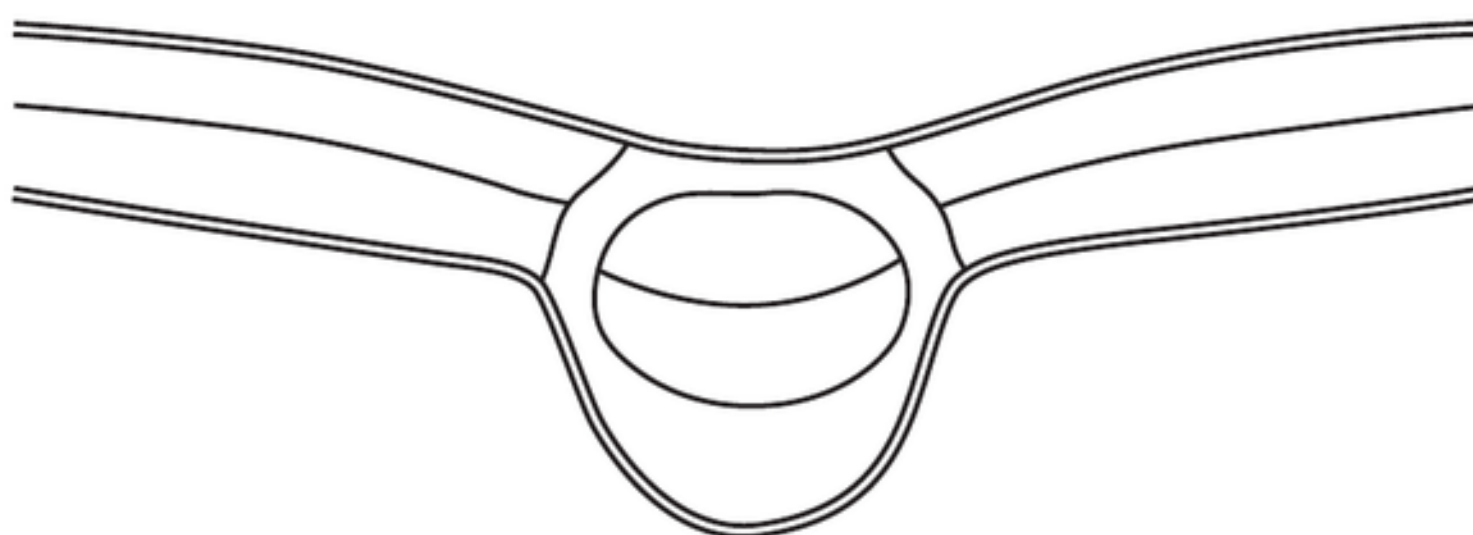


Fig. 5.2

Add a label line and the letter **X** to Fig. 5.2 to identify the location of xylem tissue. [1]

[Total: 10]

Question No 32 - (9700_s21_22_2)

Subsection Topics: (a) : 7.2 - Transport mechanisms | (b) : 7.2 - Transport mechanisms

Sugars are transported within phloem sieve tubes from a source, such as a mature leaf, to a young leaf, which acts as a sink. The young leaf also needs water and dissolved mineral ions, which arrive at the leaf within xylem vessels.

(a) As the young leaf matures, the quantity of sugar taken up by the leaf decreases to zero, but the need for water increases.

Suggest **and** explain why the quantity of sugar taken up by the developing leaf decreases to zero over time, but the need for water increases.

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..... [3]

(b) The features listed in Table 2.1 are present in one or more of the three cell types:

- companion cell
- phloem sieve tube element
- xylem vessel element.

Complete Table 2.1 using a tick (✓) if the feature is present and a cross (X) if the feature is absent.

Table 2.1

feature	companion cell	phloem sieve tube element	xylem vessel element
cytoplasm			
cell surface membrane			
lignified cell wall			
nucleus			

[4]

Answer for Question 1 (9700_m24_22_3)

Question	Answer	Marks
3(a)(i)	R endodermis ; A endodermal (tissue) S xylem ; T phloem ; <i>accept ecf if S and T both have 'vessels' after naming</i>	3
3(a)(ii)	any two from: to stop water moving through the apoplast / to force water movement to be symplastic / AW ; so that water moves from the cell wall to the cytoplasm ; AVP ; e.g. to allow control of substances into root (stele) ref. to passage cells ref. to Casparian strip / suberin	2
3(a)(iii)	sucrose / amino acid / peptide / polypeptide / protein / RNA / (named) plant hormone ; A other named sugar / named amino acid / named protein / enzyme R minerals	1
3(b)	correct label to a plasmodesma ;	1

Question	Answer				Marks
3(c)					3
	polysaccharide	monomer	glycosidic bond(s)	function	
	amylopectin	α -glucose	1,4 and 1,6	energy storage in plants	
	amylose	α -glucose ;	1,4	energy storage in plants	
	cellulose	β -glucose	1,4 ;	structural role in plant cell walls	
	glycogen	α -glucose	1,4 and 1,6	energy storage in <u>animals</u> ;	

Answer for Question 2 (9700_m25_22_1)

Question	Answer	Marks
1(a)	light / optical (microscope) ;	1
1(b)	460 / 464 (μm) ; A 450–480	1
1(c)	any one from: increase the surface area ; reach a larger volume of, soil / soil particles ; AVP ; e.g. (root hairs) increase the number of aquaporins in cell surface membrane	1
1(d)	max two if answer only refers to either Na^+ or K^+ ions any three from: 1 facilitated diffusion because, higher concentration Na^+ in soil solution / lower concentration Na^+ in root hair cells ; 2 active, transport / uptake, because, higher concentration K^+ in root hair cells / lower concentration K^+ in soil solution ; 3 ions / AW, cannot, diffuse / pass through the, cell (surface) membrane / phospholipid bilayer ; 4 (so) facilitated diffusion uses, channel / carrier proteins or active transport uses carrier proteins ;	3
1(e)	(movement of water) from cell A to cell B by osmosis ; from higher water potential to lower water potential / from less negative ψ to more negative ψ / down the water potential gradient ;	2
1(f)(i)	any four from: 1 (carbon dioxide reacts with water resulting in) carbonic acid produced ; accept from equation 2 carbonic acid dissociates to form, hydrogencarbonate (ions) / HCO_3^- , and, protons / H^+ ; accept from equation accept bicarbonate for hydrogencarbonate 3 pH of soil (solution) lowered / soil (solution) becomes more acidic ; accept correct paired data quotes as alternative to lower pH 4 at lower pH clay particles lose Fe^{2+} / H^+ displaces Fe^{2+} from clay particles ; 5 hydrogencarbonate ions attract (bound) Fe^{2+} into soil solution ; 6 AVP ; e.g. no carbonic anhydrase in soil solution, so reaction slow	4

Answer for Question 2 (9700_m25_22_1)

Question	Answer	Marks
1(f)(ii)	any three from: 1 (Fe²⁺) must cross the cell surface membrane at endodermis / Fe²⁺ moves into, cytoplasm / symplastic route ; 2 due to Casparian strip / impermeability of suberin / AW ; 3 idea that the cell regulates the, quantity / activity, of transport proteins ; 4 metabolised / changed, to insoluble iron compounds (and stored in root) ; 5 transported into / stored in, vacuole of endodermal cell ;	3

Answer for Question 3 (9700_m24_22_5)

Question	Answer	Marks
5(a)(i)	scanning (electron microscope) ;	1
5(a)(ii)	<i>Vibrio cholerae</i> ;	1
5(b)	prokaryotic cell walls are, made of peptidoglycan / made of murein / not made of cellulose ;	1

Answer for Question 4 (9700_s24_21_5)

Question	Answer	Marks
5(a)	<i>both units must be used at least once</i> <i>any three from:</i> 1 no transpiration when LVPD is 0 kPa ; 2 (both) increase in transpiration rate until 2.5 kPa ; 3 <i>H. annuus</i> rate remains constant between 2.5 and 3.0 kPa, <i>N. oleander</i> rate decreases slightly ; 4 <i>H. annuus</i> has higher rate of transpiration (at all LVPDs) ; ora for <i>N. oleander</i> 5 <i>H. annuus</i> has a higher rate of increase (between 0 and 2.5 kPa) ; A steeper gradient 6 any comparative data quote from Fig. 5.1 ; <i>must include figures and units from both axes <u>and</u> data must come from both species</i>	3
5(b)	<i>if a correct adaptation does not match the figure, allow ecf for the explanation Fig. 5.3</i> <i>any four from:</i> 1 three layers of thick-walled cells at, upper / lower, surface ; A two layers of cells under epidermis / epidermis and (two layers of) hypodermis 2 reduces, diffusion of water vapour to atmosphere / cuticular transpiration ; A increases the distance for water vapour to diffuse 3 no stomata on upper surface / stomata only on lower surface ; 4 stomata not exposed to direct sunlight / AW ; 5 (stomata in) pits / depressions / cavities / chambers / crypts / infoldings / grooves / AW (on lower side of leaf) ; 6 creates humid atmosphere in, pit / AW or reduces the, diffusion / water potential, gradient (for water vapour) ; A vapour pressure gradient A minimises effect of, external air currents / wind <i>Fig. 5.3 or Fig. 5.4</i> 7 thick walled epidermis ; 8 reduces diffusion of water vapour through lower epidermis ; 9 thick (waxy) cuticle (on epidermis / surface) ; 10 reduces diffusion of water vapour through cuticle / reduces cuticular transpiration ; A (waxy) cuticle is waterproof 11 (epidermal) hairs / trichomes (around stomata / fill pits) ; 12 reduces air movement / traps still air / creates humid atmosphere / traps water vapour or reduces the, diffusion / water potential, gradient for water vapour ;	4

Answer for Question 5 (9700_s24_22_4)

Question	Answer	Marks
4(a)	<i>allow points from correctly labelled diagram</i> (monomers of) beta-glucose / β-glucose ; R α-glucose / two β-glucoses <i>plus any two from:</i> <i>max 1 if no monomer stated</i> (joined by) 1, 4 glycosidic bonds ; A 1,4 glycosidic bonds R 1,4 <u>and</u> 1,6 bonds each (β-) glucose rotated by 180° compared to adjacent (β-)glucose ; AW linear / straight, chain / molecule; unbranched ;	3
4(b)(i)	<i>any one from:</i> increases rate of translation of, enzyme / nitrate reductase ; increases, enzyme / nitrate reductase, synthesis / concentration ; A more nitrate reductase produced <i>idea of</i> more metabolically efficient ; e.g. enzyme only produced when needed AVP ; e.g. more nitrate is reduced to nitrite / more nitrite is formed leads to increased supply of nitrite for amino acids / amino acid synthesis	1

Answer for Question 5 (9700_s24_22_4)

Question	Answer	Marks
4(b)(ii)	<i>any two from:</i> improves accuracy of results / results not by eye / results not subjective ; A detects smallest change in, (intensity of) colour / concentration / quantity provides quantitative results / obtain numerical values ; A described e.g. absorbance values / can measure absorbance/ gives percentage transmission / absorbance readings <i>idea that</i> different, intensities / shades of, colour / magenta / red-purple, relate to different, quantities / concentrations, of nitrites ; A relate to (rates of) nitrate uptake can produce calibration curve (for quantitative results) ; AVP ; e.g. can detect, (very) low concentrations / faintly coloured samples	2

Answer for Question 5 (9700_s24_22_4)

Question	Answer	Marks
4(c)(i)	<i>accept hydrogen ions / H⁺, for protons</i> <i>max 3 if no ref. to amino acids</i> <i>any four from:</i> 1 protons, moved by active transport / pumped, out of (companion) cell ; A using, energy / ATP <i>for active transport</i> 2 protons, moved into / enter / AW, cell wall / apoplast ; R if moved out to phloem sieve tube 3 proton gradient builds up in, apoplast / cell wall ; A higher concentration A high concentration if mp4 gained 4 protons move back (into companion cell), by facilitated diffusion / AW ; e.g. down, electrochemical / concentration, gradient from high(er) to low(er) concentration A diffuse <i>if movement is described through a transport protein in mp5</i> 5 protons cotransport amino acids or amino acids move with protons through, a cotransporter / a cotransport protein / (amino acid) transporter ; 6 amino acids, transported / AW, against their concentration gradient ;	4
4(c)(ii)	plasmodesmata present ; A movement is down the, concentration / diffusion, gradient A because there is a high(er) concentration in the companion cell ora for phloem sieve tube (sap)	1

Answer for Question 5 (9700_s24_22_4)

Question	Answer	Marks										
4(d)	0.2 mmol dm⁻³ constant rate v 5.0 mmol dm⁻³, rate not constant / described ; 0.2 mmol dm⁻³ lower rate than 5.0 mmol dm⁻³ ; ora 5.0 mmol dm⁻³ higher rate A faster / slower, rate for higher / lower, rate A (overall) steeper rate / less steep rate calculated rates to support ;	2										
4(e)	any four from: 1 (experiments suggest mainly) active transport / active uptake ; A uptake, is an active process / needs energy / needs ATP <i>if mp8 given, allow 'active transport and facilitated diffusion'</i> 2 comparison of experiments with control, any one ; <table><tr><th>expt</th><th>discussion point</th></tr><tr><td>1</td><td>oxygen required for (complete) uptake A aeration required or almost no /AW, uptake, with no oxygen / in anaerobic conditions</td></tr><tr><td>2</td><td>almost no / AW, uptake, in, low temperature / at 3°C or uptake, higher / AW, at 30°C / in control</td></tr><tr><td>3</td><td>proteins / enzymes, are, required for / involved in, uptake or (much) lower / AW, uptake when, proteins not synthesised / protein synthesis inhibitor present</td></tr><tr><td>4</td><td>slightly lower / very similar, uptake / AW, without any bacteria or slightly higher / very similar, uptake / AW, with bacteria (control)</td></tr></table> 3 one comparative result / manipulated data, with units, to support mp2 ;	expt	discussion point	1	oxygen required for (complete) uptake A aeration required or almost no /AW, uptake, with no oxygen / in anaerobic conditions	2	almost no / AW, uptake, in, low temperature / at 3°C or uptake, higher / AW, at 30°C / in control	3	proteins / enzymes, are, required for / involved in, uptake or (much) lower / AW, uptake when, proteins not synthesised / protein synthesis inhibitor present	4	slightly lower / very similar, uptake / AW, without any bacteria or slightly higher / very similar, uptake / AW, with bacteria (control)	4
expt	discussion point											
1	oxygen required for (complete) uptake A aeration required or almost no /AW, uptake, with no oxygen / in anaerobic conditions											
2	almost no / AW, uptake, in, low temperature / at 3°C or uptake, higher / AW, at 30°C / in control											
3	proteins / enzymes, are, required for / involved in, uptake or (much) lower / AW, uptake when, proteins not synthesised / protein synthesis inhibitor present											
4	slightly lower / very similar, uptake / AW, without any bacteria or slightly higher / very similar, uptake / AW, with bacteria (control)											

Answer for Question 5 (9700_s24_22_4)

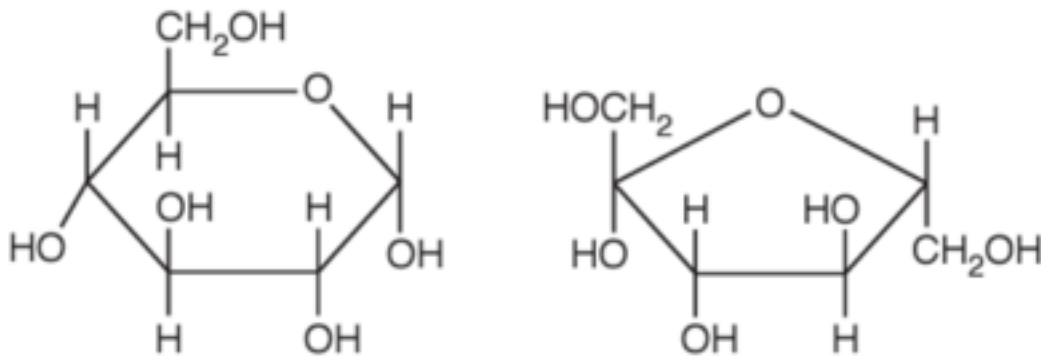
Question	Answer					Marks	
4(e)	experiment	experiment v control	or	lower by	only needs to state control value once somewhere in response		
	1	0.4 v 10.9 $\mu\text{mol g}^{-1}$		10.5 $\mu\text{mol g}^{-1}$			
	2	0.6 v 10.9 $\mu\text{mol g}^{-1}$		10.3 $\mu\text{mol g}^{-1}$			
	3	1.4 v 10.9 $\mu\text{mol g}^{-1}$		9.5 $\mu\text{mol g}^{-1}$			
	4	10.0 v 10.9 $\mu\text{mol g}^{-1}$		0.9 $\mu\text{mol g}^{-1}$			
	discussion points						
	4 aerobic respiration needs oxygen ;						
	5 lower temperature means lower activity of enzymes involved in respiration ;						
	6 ref. to ATP (for active transport) ; e.g. (aerobic) respiration produces ATP less respiration means less ATP produced no ATP for, conformational change / AW (of carrier protein)						
	7 some (facilitated) diffusion because some uptake without oxygen ;						
	8 protein synthesis needed for transport proteins ; A membrane / transport / carrier / channel, proteins not being synthesised A no protein synthesis so less ATP synthase						
	9 effect of lower temperature on transport ; ora for control e.g. reduces rate of (facilitated) diffusion affects, ATPase / carrier protein, for active transport transport proteins less efficient at low temperature						
	10 bacteria will have, little / no, effect on uptake or (normally) bacteria (associated with roots), increase / help, nitrate uptake ;						
	11 AVP ; e.g. idea that nitrate uptake involves metabolic processes						

Answer for Question 6 (9700_s24_23_4)

Question	Answer	Marks
4(a)	<i>Max 3 for suberin, max 3 for lignin</i> <i>any four from:</i> 1 lignin / suberin, is, hydrophobic / (partially) impermeable to water / AW ; e.g. waterproof / barrier to water <i>suberin</i> 2 suberin found in, Casparian strip / endodermal cells / endodermis ; 3 water must move from apoplast (pathway) to, symplast (pathway) / cytoplasm (at endodermis) ; 4 allows control of solutes / AW, before entering, endodermal cells / xylem ; A helps to prevent, toxins / bacteria / AW, entering xylem <i>in context of mp3</i> <i>lignin</i> 5 lignin found in, cell walls of xylem vessel elements / walls of xylem vessels ; A xylem / vessel, elements 6 <i>idea of</i> lignin / lignified wall, prevents water leaving xylem / loss of water from xylem ; 7 lignified walls, prevents, (inward) collapse of / compression of / AW, xylem ; R bursting 8 provides strength / secondary thickening, for (structural) support (of xylem) ; 9 <i>AVP : e.g. ref. to lignin as part of endodermis</i>	4

Question	Answer	Marks
4(b)	<i>max 4 if no reference to laccase / monolignols</i> <i>allow substrate(s) for monolignols</i> <i>any five from:</i> 1 laccase uses induced fit ; 2 <i>idea that</i> active site shape not fully complementary to (shape of) monolignols ; 3 active site changes shape to, fit / bind to, monolignols ; AW 4 becomes fully <u>complementary</u> ; 5 forming enzyme-substrate complex ; 6 lowers, activation energy / energy of activation; 7 suggestion of how activation energy is lowered ; 8 laccase returns to original shape, after product leaves active site / for re-use / AW ; 9 AVP ; e.g. <i>suggestion that</i>, copper ions are, cofactors / necessary for enzyme action <i>suggestion that</i> monolignols are held in place by (temporary) H bonds	5
5(a)	<i>any two from:</i> cells secrete ligands or	2

Answer for Question 7 (9700_w24_21_4)

Question	Answer	Marks
4(a)(i)	glycosidic ;	1
4(a)(ii)	 any three from: label one monomer correctly ; α-glucose with a hydroxyl group on C1 ; fructose drawn with a hydroxyl group on C2 ; water used in the reaction ;	3
4(b)(i)	sieve plate ;	1

Answer for Question 7 (9700_w24_21_4)

Question	Answer	Marks
4(b)(ii)	any four from: 1 carbohydrate is transported in (phloem) sieve tubes ; A sucrose transported A sieve tube elements 2 as the percentage of outer stem tissue removed increases, the quantity of phloem (sieve tubes) remaining decreases ; 3 less, mass flow / translocation ; 4 0 mg at 100% removal because all phloem removed / AW ; 5 carbohydrate is not transported in xylem tissue, as there is no transport when xylem tissue is left intact ; 6 <i>ref. to</i> movement to lower part of stem from source to sink ; 7 AVP ; e.g. <i>suggestion that</i> most of the (active) phloem is in the inner part of the outer stem <i>idea that</i> phloem sieve tubes are arranged in layers	4

Answer for Question 7 (9700_w24_21_4)

Question	Answer	Marks
4(c)	any four from: max 3 1 example of structural change to sucrase ; e.g. translation stops prematurely / truncated polypeptide / AW change in the primary structure / different amino acid(s) polypeptide does not, fold into / form, (correct) tertiary structure 2 suggestion of why sucrase is non-functional ; e.g. active site, not complementary / changed shape binding site changed shape, sucrose does not bind to active site catalytic site changed shape, glycosidic bond cannot be broken 3 polypeptide not produced as mRNA does not attach to ribosome ; 4 polypeptide recognised as abnormal and degraded ; max 3 5 deletion mutation is loss of one or more nucleotides (in the gene coding for sucrase) ; 6 (causes a) change in the sequence of, nucleotides / bases / base pairs, (in the, gene coding for sucrase / DNA molecule) ; 7 (causes a) change in the sequence of, nucleotides / bases, in, mRNA / an mRNA molecule ; 8 consequence to codons ; (if not a deletion of, three / multiples of three) all the codons after the deletion mutation are altered causes a frameshift (deletion, of three / multiples of three) one or more codons absent, then same sequence 9 mutation may, form a premature stop codon / introduce a stop codon ;	4

Answer for Question 8 (9700_w24_22_1)

Question	Answer	Marks								
1(a)(i)	<i>all correct for one mark ;</i> <table><tr><td>palmitic acid</td><td>0</td></tr><tr><td>linoleic acid</td><td>2</td></tr><tr><td>stearic acid</td><td>0</td></tr><tr><td>palmitoleic acid</td><td>1</td></tr></table>	palmitic acid	0	linoleic acid	2	stearic acid	0	palmitoleic acid	1	1
palmitic acid	0									
linoleic acid	2									
stearic acid	0									
palmitoleic acid	1									
1(a)(ii)	circle drawn around palmitic acid <u>and</u> around stearic acid ;	1								
1(a)(iii)	COOH / carboxyl (group) / carboxylic acid (group) ; A carbonyl group and hydroxyl group R if response includes incorrect groups	1								

Answer for Question 8 (9700_w24_22_1)

Question	Answer	Marks
1(a)(iv)	<i>if no ref. to fatty acids, allow one mark for (some) triglycerides may, be saturated / have no double bonds (in hydrocarbon chain,) <u>and</u> (some) may, be unsaturated / have double bonds</i> I 'tails' any two from: 1 each triglyceride has three fatty acids ; 2 fatty acids can be, <u>saturated</u> / with no double bonds, <u>and</u>, <u>unsaturated</u> / with double bonds ; A unsaturated fatty acids can have a different number of double bonds 3 fatty acids can have different, (hydrocarbon chain) lengths / number of carbons ; 4 detail from Table 1.1 to support mp2 or 3 ; saturated = palmitic / stearic v unsaturated = oleic / linoleic / palmitoleic or 1 double bond = oleic / palmitoleic v 2 double bonds = linoleic or oleic / linoleic / stearic = 18C v palmitic / palmitoleic = 16C 5 <i>idea of</i> a particular fatty acid, can be located at a different position in a triglyceride / can form a bond with any one of the three (functional) hydroxyl groups ; 6 <i>ref. to</i> different environmental conditions of plants grown in different regions ; e.g. colder conditions and oils having (more triglycerides with) higher proportion of unsaturated fatty acids 7 <i>idea of</i> (shared triglycerides) have structures (most) suited as energy stores ; A example e.g. (have fatty acids with) longest hydrocarbon chains easiest to, hydrolyse / release hydrogen atoms have greater energy value than others 8 <i>ref. to</i> ease of, production / synthesis ; 9 <i>idea that</i> shared triglycerides composed of the fatty acids (present) in highest proportions ; e.g. <i>using Table 1.1 to determine the most common 2 or 3 fatty acids</i> 'could all have the same fatty acid combination from oleic acid and / or palmitic acid and/or linoleic acid' (any two)	2

Answer for Question 8 (9700_w24_22_1)

Question	Answer	Marks
1(b)	any two from: 1 water is, a polar molecule / polar / dipolar ; A water is a dipole A description e.g. the O atom (of water) has, a slightly negative / δ^-, charge, <u>and</u> the H atoms have a slightly positive / δ^+, charge 2 water can form, hydrogen bonds / H-bonds, with, glycerol / polar substances ; ora = water cannot form H-bonds with, triglycerides / non-polar substances 3 glycerol / polar molecules / ions, <u>interact</u> with water (molecules) / are attracted to water (molecules) / are hydrophilic ; A idea that water, attracts / collects around / AW, ions / charged substances ora = triglycerides / non-polar / uncharged, molecules, do not interact with water / repel water / are hydrophobic I 'tails'	2
1(c)	(phloem) <u>sieve tube element</u> ; (<i>question asks for type of cell</i>) A sieve element	1

Answer for Question 9 (9700_w24_22_6)

Question	Answer	Marks
6(a)	any four from: - cell wall, pathway / route / AW ; R crossing membranes / passing through vacuoles / passing through cytoplasm, <i>in context of passage to endodermis</i> I diffuses / osmosis / active transport - movement (also), through intercellular spaces / in spaces between cells ; R intracellular spaces - named cell layer in <u>apoplast</u> pathway to endodermis ; e.g. epidermal cells / root hair cells cells of cortex / cortical cells / parenchyma cells <i>must be in context of cell walls</i> - cannot cross / stops at, Casparian strip (of endodermal cells) ; - detail ; made of, suberin or described as a, waxy / waterproof / impermeable (layer / substance / material in cell walls) (overall) movement down a water potential gradient ; R ref. to osmosis / active transport <i>context of across root or from root to xylem (owing to overall root to, leaf / atmosphere, gradient)</i> - AVP ; e.g. non-living pathway / does not cross membranes, until the endodermis idea that water needs to pass across a cell (surface) membrane to control substances entering xylem	4

Answer for Question 9 (9700_w24_22_6)

Question	Answer				Marks
6(b)	net movement of K ⁺	membrane protein needed (yes or no)	ATP used (yes or no)	name of transport mechanism	3
	against the concentration gradient	yes	yes	active, transport / uptake	
	down the concentration gradient	yes	no	facilitated diffusion	
	one mark each correct column ;;;				
	if no marks gained, allow one mark for a correct row				

Answer for Question 10 (9700_m23_22_3)

Question	Answer	Marks
3(a)(i)	cell Y shows, a sieve plate / sieve pores ; ora idea that the sieve plates are at different heights in the stem / the section misses the sieve plate in cell X / AW ;	2
3(a)(ii)	any four from: 1 (protein in) companion cell surface membrane, moves / pumps, protons into, cell wall / apoplast ; 2 using ATP / by active transport ; 3 establishes a proton gradient ; 4 protons move into companion cell, by facilitated diffusion ; A described e.g. down the, electrochemical / concentration, gradient 5 protons cotransport sucrose / protons and sucrose pass through a cotransporter (protein), into companion cell ; 6 sucrose moves against its concentration gradient ; 7 diffusion of sucrose into phloem sieve tube, through plasmodesmata ; A all marking points from an annotated diagram	4

Answer for Question 10 (9700_m23_22_3)

Question	Answer	Marks
3(b)(i)	this could be answered diagrammatically or in text, e.g. any two from: idea that oxygen has a small negative charge and hydrogen has a small positive charge ; idea that a hydrogen bond forms between the oxygen of one water molecule and the hydrogen of a neighbouring water molecule ; AVP ; e.g. oxygen is more electronegative than hydrogen	2
3(b)(ii)	any three from: 1 ref. to cohesion between water molecules ; 2 ref. to adhesion / hydrogen bonding, between water molecules and, cellulose / hydrophilic parts of lignin (in cell wall) ; A hydrophilic parts of cell wall 3 formation of continuous column / AW ; 4 (column) pulled up by, transpiration / evaporation / transpiration pull ;	3

Answer for Question 10 (9700_m23_22_3)

Question	Answer	Marks
3(b)(iii)	any two from: ref. to plant leaves heat up, when light absorbed for photosynthesis / at high (ambient) temperatures ; (high latent heat of vaporisation leads to large cooling effect / removal of (large quantities of) heat energy, by evaporation ; reduces, protein / enzyme, denaturation ; reduces rate of water loss by, transpiration / evaporation, at high temperatures ; AVP ;	2

Answer for Question 11 (9700_s23_21_6)

Question	Answer	Marks
6(a)	plasmodesma ;	1
6(b)	Casparian strip ; I suberin / endodermis	1
6(c)	R if choice of terms given osmosis ; transpiration pull / cohesion-tension ; I mass flow / adhesion / down a water potential gradient evaporation ; diffusion ;	4

Answer for Question 12 (9700_s23_22_2)

Question	Answer	Marks																											
2(a)	one mark each row to max 3 or = requires either root apical meristem or root cap cells statement <table> <tr> <th><i>root apical meristem cells</i></th><th></th><th><i>root cap cells</i></th></tr> <tr> <td>(some) cells in, mitosis / different stages of cell cycle ;</td><td>or</td><td>no cells in mitosis / all cells in interphase ; A no chromosomes visible / only chromatin visible</td></tr> <tr> <td>(some) cells in, prophase / metaphase / telophase ; A chromosomes visible (in some cells)</td><td></td><td>N/A</td></tr> <tr> <td>(generally) smaller (size) ; A less cytoplasm</td><td>or</td><td>(generally) larger (size) ; A more cytoplasm</td></tr> <tr> <td>larger nucleus in proportion to, size of cell / quantity of cytoplasm ;</td><td>or</td><td>smaller nucleus in proportion to, size of cell / quantity of cytoplasm ;</td></tr> <tr> <td>nucleoli / nucleolus, (more) visible / prominent / AW ;</td><td>or</td><td>nucleoli / nucleolus, not visible / not prominent / AW ;</td></tr> <tr> <td>(generally all) cuboidal / same shape ; A rectangular / regular (shape)</td><td>or</td><td>variety of shapes / shape described ; A irregular / circular</td></tr> <tr> <td><i>ref.</i> arrangement of cells ; e.g. rows / chains / tightly packed / compact / uniform / regular</td><td>or</td><td><i>ref.</i> arrangement of cells ; e.g. irregular / loosely packed / more intercellular spaces</td></tr> <tr> <td>AVP ; e.g. all / more, cells have nuclei cells not, sloughing off / detaching</td><td>or</td><td>AVP ; e.g. some have no nucleus some cells, sloughing off / detaching</td></tr> </table>	<i>root apical meristem cells</i>		<i>root cap cells</i>	(some) cells in, mitosis / different stages of cell cycle ;	or	no cells in mitosis / all cells in interphase ; A no chromosomes visible / only chromatin visible	(some) cells in, prophase / metaphase / telophase ; A chromosomes visible (in some cells)		N/A	(generally) smaller (size) ; A less cytoplasm	or	(generally) larger (size) ; A more cytoplasm	larger nucleus in proportion to, size of cell / quantity of cytoplasm ;	or	smaller nucleus in proportion to, size of cell / quantity of cytoplasm ;	nucleoli / nucleolus, (more) visible / prominent / AW ;	or	nucleoli / nucleolus, not visible / not prominent / AW ;	(generally all) cuboidal / same shape ; A rectangular / regular (shape)	or	variety of shapes / shape described ; A irregular / circular	<i>ref.</i> arrangement of cells ; e.g. rows / chains / tightly packed / compact / uniform / regular	or	<i>ref.</i> arrangement of cells ; e.g. irregular / loosely packed / more intercellular spaces	AVP ; e.g. all / more, cells have nuclei cells not, sloughing off / detaching	or	AVP ; e.g. some have no nucleus some cells, sloughing off / detaching	3
<i>root apical meristem cells</i>		<i>root cap cells</i>																											
(some) cells in, mitosis / different stages of cell cycle ;	or	no cells in mitosis / all cells in interphase ; A no chromosomes visible / only chromatin visible																											
(some) cells in, prophase / metaphase / telophase ; A chromosomes visible (in some cells)		N/A																											
(generally) smaller (size) ; A less cytoplasm	or	(generally) larger (size) ; A more cytoplasm																											
larger nucleus in proportion to, size of cell / quantity of cytoplasm ;	or	smaller nucleus in proportion to, size of cell / quantity of cytoplasm ;																											
nucleoli / nucleolus, (more) visible / prominent / AW ;	or	nucleoli / nucleolus, not visible / not prominent / AW ;																											
(generally all) cuboidal / same shape ; A rectangular / regular (shape)	or	variety of shapes / shape described ; A irregular / circular																											
<i>ref.</i> arrangement of cells ; e.g. rows / chains / tightly packed / compact / uniform / regular	or	<i>ref.</i> arrangement of cells ; e.g. irregular / loosely packed / more intercellular spaces																											
AVP ; e.g. all / more, cells have nuclei cells not, sloughing off / detaching	or	AVP ; e.g. some have no nucleus some cells, sloughing off / detaching																											

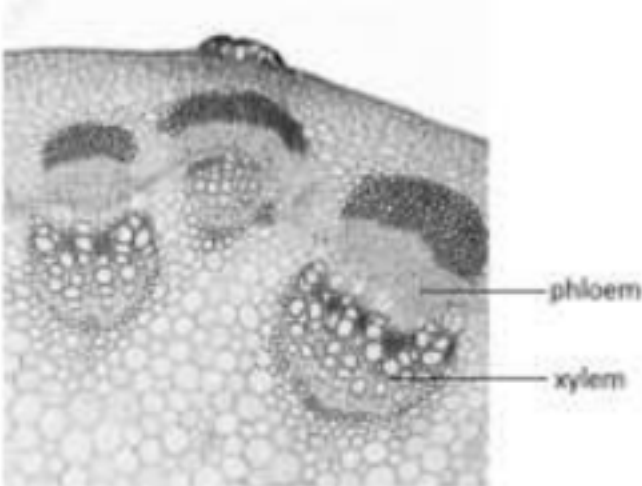
Answer for Question 12 (9700_s23_22_2)

Question	Answer	Marks
2(b)	any three from: max 1 mark (from mp1 / mp2) if response completely based on water movement within the plant mps 1-4: ref. to water <u>molecules</u>, needed once only / apply ecf water <u>molecules</u> form hydrogen bonds ; A H bonds / H bonding cohesion between water <u>molecules</u> (in spaces) ; A cohesive force between water molecules cohesion to water <u>molecules</u>, adhering / AW, to soil, particles / clumps ; adhesion of water <u>molecules</u> to, soil, surface / particles / clumps / mucilage / polysaccharides ; A adhesive force of water <u>molecules</u> AVP ; e.g. clumps provide, areas / (small) spaces / place, in which water collects <i>idea of</i> stable environment e.g. reduced movement of water, in / around clumps I keeps water around the, soil clumps / the root tip	3
2(c)	extracellular (enzymes) ;	1
2(d)(i)	more than two / three or more / many / large number of / polymer of, monosaccharides / sugar monomers / sugar units / simple sugars / carbohydrate subunits / AW ; A macromolecule <i>for large number of</i> R if includes incorrect example of a polysaccharide, e.g. sucrose <i>plus one from:</i> joined by / AW, glycosidic bonds ; <i>idea of</i> repeating, subunits / units / monomers / AW ;	2

Answer for Question 12 (9700_s23_22_2)

Question	Answer	Marks
2(d)(ii)	<i>all correct (NH₂ or COOH groups on left or right) ;</i> R-group / side chain, is variable or different amino acids have different, R-groups / side chains ; AW <i>this can be annotated on the diagram</i>	2
2(d)(iii)	<i>any three from:</i> I <i>ref. to concentration of water / solute concentration</i> A ψ for water potential mineral ions / nutrients, are solutes / dissolve in water ; (solutes) decrease / lower, water potential, within cell / in cytosol / in cytoplasm ; A water potential becomes, more negative / low increases / steep(er) / presence of / AW, water potential gradient ; A the difference in ψ between soil solution and cell increases A water moves from high to low water potential water follows osmotically / water enters by osmosis ; <i>in context of, presence / uptake, of mineral ions</i>	3

Answer for Question 13 (9700_s23_23_5)

Question	Answer	Marks
5(a)	phloem (identified) ; xylem (identified) ; e.g. two marks for: 	2
5(b)(i)	any four from: 1 (transport is by) mass flow ; 2 entry of sucrose into phloem sieve tube, from companion cell / through plasmodesmata ; 3 sucrose, is dissolved in water / is part of phloem sap / lowers water potential ; 4 (transport is) down a hydrostatic pressure gradient / from high hydrostatic pressure to low hydrostatic pressure ; <i>high hydrostatic pressure</i> 5 water moves into phloem sieve tube, by osmosis / down water potential gradient / from xylem (at source) ; 6 increased volume increases hydrostatic pressure ; <i>hydrostatic needed once only</i> <i>low hydrostatic pressure</i> 7 (at sink / in other parts of plant) sucrose unloaded, water follows osmotically ; AW	4

Answer for Question 13 (9700_s23_23_5)

Question	Answer	Marks
5(b)(ii)	<i>any two from:</i> <i>respiration</i> 1 less / no, ATP produced from aerobic respiration ; A ETC / oxidative phosphorylation 2 less ATP / energy, for sucrose synthesis (in mesophyll cell) ; <i>in context of companion cell</i> 3 less / no, ATP / energy, for, proton gradient / active transport of protons (out of companion cell) / AW ; A hydrogen ions / H⁺ for protons 4 less sucrose cotransported (with, protons / hydrogen ions / H⁺) into companion cells ; 5 (less sucrose in companion cells means) decreased diffusion of sucrose (via plasmodesmata) into phloem sieve tubes ; <i>if no marks gained, allow 1 mark for less ATP for, active loading / active transport of protons</i>	2
5(c)	Benedict's solution does not react with, non-reducing sugar / sucrose or Benedict's solution only reacts with, reducing sugar / glucose ; AW A Benedict's is, a test for reducing sugars / not a test for non-reducing sugars <i>solution A because</i> sugar present in, cytoplasm / solution A, (mainly) reducing sugars / glucose <u>and</u> sugar in, phloem sap / solution B, is mainly, sucrose / non-reducing sugar or <i>solution B because</i> phloem sap / solution B, contains, a higher concentration of / AW, reducing sugar / glucose, (than, cytoplasm / solution A) ; A in cytoplasm glucose stored as, polysaccharide / starch	2

Answer for Question 14 (9700_s23_23_4)

Question	Answer	Marks								
4(a)(i)	<table><thead><tr><th>description</th><th>level of protein structure</th></tr></thead><tbody><tr><td>a gliadin protein is a single polypeptide that forms a compact structure</td><td>tertiary</td></tr><tr><td>20% of the amino acids in a glutenin molecule are glycine</td><td>primary</td></tr><tr><td>gliadin and glutenin molecules contain regions of β-pleated sheets</td><td>secondary</td></tr></tbody></table> 1 mark per correct row ;;;	description	level of protein structure	a gliadin protein is a single polypeptide that forms a compact structure	tertiary	20% of the amino acids in a glutenin molecule are glycine	primary	gliadin and glutenin molecules contain regions of β -pleated sheets	secondary	3
description	level of protein structure									
a gliadin protein is a single polypeptide that forms a compact structure	tertiary									
20% of the amino acids in a glutenin molecule are glycine	primary									
gliadin and glutenin molecules contain regions of β -pleated sheets	secondary									

Answer for Question 14 (9700_s23_23_4)

Question	Answer	Marks
4(a)(ii)	<i>any one relevant: e.g.</i> RNA / gene, splicing, not needed / does not occur ; R DNA splicing <i>ref. to</i> all primary transcript is a coding sequence ; A primary transcript has the same sequence as the mRNA no nucleotides removed, from the primary transcript / after transcription ; no process of exon joining / AW ; no non-coding sequences, so introns to not need to be removed ; no alternative RNA splicing / exons not joined in different combinations ; A only one type of mRNA formed / mRNA formed always the same <i>idea that</i> only other post transcriptional processing occurs ; e.g. 5' G (guanine) cap / poly A tail	1
4(b)(i)	endocytosis ; A pinocytosis A described detail ; e.g. invagination of membrane / AW use of ATP A active process / energy needed formation of (endocytotic / pinocytotic) vesicle <i>if mp1 gained from description, mp2 must be another detail</i> <i>accept other named transport mechanism, with detail</i>	2

Answer for Question 14 (9700_s23_23_4)

Question	Answer	Marks
4(b)(ii)	<i>any four from:</i> 1 <i>ref. presence of, non-self / foreign, antigen</i> or gliadin acts as antigen or <i>ref. to antigen presentation (by macrophages) ;</i> 2 <i>recognition / activation / AW, of (specific) B- / T-lymphocytes ;</i> A clonal selection 3 <i>clonal expansion of B-lymphocytes (and T-lymphocytes) ; AW</i> e.g. form a clone of cells (by mitosis) / divide many times by mitosis 4 <i>T-helper cells, secrete / release, cytokine ;</i> 5 <i>cytokine stimulates, humoral / B-lymphocyte, response ;</i> <i>if mp4 and mp5 not gained allow one mark for T-helper cells stimulate B-lymphocyte response</i> 6 <i>B-lymphocytes (differentiate to) form plasma cells ;</i> 7 <i>plasma cells, produce / secrete, (anti-gliadin) antibodies ;</i>	4

Answer for Question 15 (9700_w23_21_3)

Question	Answer	Marks
3(a)	(cell type A) phloem sieve tube element ; <i>plus any two from:</i> connect the cytoplasm of the two cells / <i>ref. to</i> the symplast pathway ; <i>idea of</i> allow (rapid) diffusion of, sucrose / named molecules, from one cell to an adjacent cell / AW ; <i>idea of</i> efficiency of, loading into / unloading from, sieve tubes ;	3

Answer for Question 15 (9700_w23_21_3)

Question	Answer	Marks															
3(b)	<table> <tr> <th>feature of polysaccharide</th><th>callose molecule</th><th>cellulose molecule</th></tr> <tr> <td>monosaccharide used to synthesise the polysaccharide</td><td></td><td>beta / β, glucose ; R B glucose</td></tr> <tr> <td>bond connecting the monomers</td><td>1, 3 glycosidic bond ;</td><td></td></tr> <tr> <td>shape of molecule</td><td></td><td>straight / linear ;</td></tr> <tr> <td>orientation of monosaccharides in the molecule</td><td>adjacent glucose molecules same way up / AW ;</td><td></td></tr> </table>	feature of polysaccharide	callose molecule	cellulose molecule	monosaccharide used to synthesise the polysaccharide		beta / β , glucose ; R B glucose	bond connecting the monomers	1, 3 glycosidic bond ;		shape of molecule		straight / linear ;	orientation of monosaccharides in the molecule	adjacent glucose molecules same way up / AW ;		4
feature of polysaccharide	callose molecule	cellulose molecule															
monosaccharide used to synthesise the polysaccharide		beta / β , glucose ; R B glucose															
bond connecting the monomers	1, 3 glycosidic bond ;																
shape of molecule		straight / linear ;															
orientation of monosaccharides in the molecule	adjacent glucose molecules same way up / AW ;																
3(c)	any three from: (hydrogen bonding) gives adhesion between water molecules and, cellulose / hydrophilic parts of lignin (in xylem wall) ; (hydrogen bonding) gives cohesion between water molecules ; formation of continuous column / AW ; A adhesion, prevents column of water collapsing / AW transpiration pull ; A water, drawn up / pulled up by transpiration / pulled up by evaporation detail ; e.g. water evaporating from spongy mesophyll surfaces water vapour lost from, leaf / plant, during transpiration <i>idea of</i> creates tension AVP ; <i>if mp 1 and mp 2 are not awarded, allow one mark for reference to cohesion <u>and</u> adhesion</i>	3															

Answer for Question 15 (9700_w23_21_3)

Question	Answer	Marks
3(d)	<i>any two from:</i> hydrogen bonds between water molecules must break for water, to change state / evaporate / AW ; loss of, heat / energy for, evaporation / transpiration (will cool the, leaf / plant) ;	2

Answer for Question 16 (9700_w23_21_2)

Question	Answer	Marks
2(a)	X (nucleolus) synthesis / AW of, ribosomal subunits / ribosomes ; A synthesis of organelles that are the sites of protein synthesis Y (chromatin) contains gene(s), coding for the polypeptide(s) / AW ; A site, of transcription / for production of mRNA	2
2(b)(i)	primary ;	1
2(b)(ii)	any one from: carboxylic acid / carboxyl, group ; A both have C=O contain carbon / hydrogen / oxygen ;	1

Answer for Question 16 (9700_w23_21_2)

Question	Answer	Marks
2(b)(iii)	any three from: ref. to role in / forms part of, overall 3D shape ; A tertiary / quaternary structure A forms part of hydrophobic region of ghrelin allows ghrelin to bind to receptor ; allows, ghrelin / part of ghrelin, to have a complementary shape / be complementary (to the receptor) ; A description suggested detail ; e.g. interacts with hydrophobic region of the receptor molecule (for binding) AVP ; e.g. help interaction with / embeds in, hydrophobic portion of the cell surface membrane <i>in context of bringing a complementary part of the molecule closer to receptor for binding</i> suggestion that fatty acid chain allowed, incorporation into / attachment to, a transport molecule in plasma to reach target cell ref. to effect of binding triggering reactions inside the cell ;	3
2(c)(i)	1.8% ; working ; $\frac{30 \times 3}{5000} \times 100$ codons for 29 amino acids (including start met) and a stop codon allow 1 mark if only 28 or 29 instead of 30, so 1.7% answer obtained	2

Answer for Question 16 (9700_w23_21_2)

Question	Answer	Marks
2(c)(ii)	<i>any two from:</i> introns / non-coding regions, removed / AW ; exons / coding regions, are joined together ; gene splicing / RNA splicing ; R DNA splicing AVP ; e.g. guanine (cap) added (to 5' end) poly A tail / many As, added (to 3' end)	2

Answer for Question 17 (9700_w23_22_6)

Question	Answer	Marks
6(a)	xylem vessel elements ; A singular A vessel elements A xylem elements	1
6(b)	any two from: transpiration pull ; A water, drawn up / pulled up owing to / AW, water evaporating from spongy mesophyll surfaces / water vapour lost from, leaf / plant, during transpiration ; <i>ref. to transpiration not required if transpiration pull stated</i> (overall) water potential gradient ; <i>in context of creates pulling force</i> <i>low water pressure at top and high water p at bottom</i> A pressure gradient A hydrostatic pressure gradient cohesion <u>and</u> adhesion (of water molecules) / cohesive and adhesive forces (of water) ; A cohesion between water molecules or adhesion between water molecules and (xylem vessel) walls / cellulose / hydrophilic parts of lignin	2

Answer for Question 17 (9700_w23_22_6)

Question	Answer	Marks
6(c)(i)	any two from: 1 (lignified wall / lignin) prevents, (inward) collapse / compression / AW (from tensions created) ; R bursting 2 (lignified wall / lignin) rigid / strong / secondary thickening, for support (of xylem vessels) ; R support, stem / plant 3 adhesion of water to hydrophilic groups in lignin, to maintain column of water / for water pathway / for transpiration stream / AW ; 4 waterproofing properties (of lignin) / AW / water prevented from leaving xylem vessels (supports idea of continuous columns) ; 5 lignification, associated with cell death / allows formation of hollow cells / allows formation of hollow tubes (for minimum resistance to flow) ; 6 AVP ; cell walls rigid to allow tension to develop	2
6(c)(ii)	any one from: cell death / apoptosis ; loss of cell contents / become hollow ; A loss of (all) organelles R idea that some organelles remain loss of cytoplasm ; A loss of protoplasm loss of nucleus ; AVP ; e.g. formation of pits	1

Answer for Question 18 (9700_w23_22_2)

Question	Answer	Marks
2(a)	secondary (structure) ;	1
2(b)	any one from: <i>idea that</i> area to be, hydrolysed / AW, could be between same amino acids ; A ref. to (always), hydrolyses / breaks down / acts on, peptide bonds suggestion that active site has (some) flexibility for, hydrolysing / binding to / AW, similar substrates ; (proteins / substrates) similar shape(s) so fit active site ; active site and, substrates / proteins, (still) have complementary shapes ; R 'complementary to the antigen or the shape' AVP ; e.g. (large enzyme / enzyme complex, with) more than one active site	1

Answer for Question 18 (9700_w23_22_2)

Question	Answer	Marks
2(c)	any three from: fibrous ; A not globular I structural insoluble / does not dissolve / does not dissolve easily ; (high proportion of) disulfide bonds / disulfide bridges / covalent bonds (because of cysteines) ; high proportion of / many / AW, hydrogen bonds (between polypeptides) ; high proportion of / many, hydrophobic interactions ; A many, amino acids with hydrophobic R-groups / hydrophobic R-Groups tight / close, packing, of, chains / polypeptides / molecules ; I triple helix AVP ; e.g. arranged so peptide bonds are not accessible parts of molecule needing to bind to active site not accessible many amino acids with small R-groups / small amino acids I details specific to collagen e.g. gly every third amino acid amino acids	3

Answer for Question 18 (9700_w23_22_2)

Question	Answer			Marks
2(d)	keratinase	temperature range at 60% relative activity / °C	pH range at 60% relative activity	4
	K12	41 – 63	6.8 / 6.9 – 8.4 ;	
	A22	36 / 36.5 – 57 ; A 57.1 / 57.2	6.0 – 9.0	
	P3	29 – 56	5.3 – 7.5	
	P3 ; A22 ;			

Answer for Question 18 (9700_w23_22_2)

Question	Answer	Marks
2(e)	<i>must have pH <u>and</u> °C <u>and</u> %, at least once max 2 if only Fig. 2.1 or only Fig. 2.2 used for the response.</i> <i>any three from:</i> <i>advantage from Fig. 2.1 (temperature)</i> 1 A22 <u>and</u> K12, active / remove stains, at a wide range of temperature or stated (active) temperature range of, A22 is 20.5 / 21 °C or K12 is 22 °C or use of Fig. 2.1 to give % activity and stated temperature of, good / above 60%, activity at, medium / hotter, temperature washes for, A22 / K12 ; or K12 active at low temperature (washes) ; A data e.g. 37–40% activity at 20 °C / 41–43% activity at 30 °C <i>disadvantage from Fig. 2.1 (temperature)</i> 2 low activity / poor stain removal, at 30 °C / 70 °C / 80 °C, for A22 or at 20 °C / 30 °C / 70 °C, for K12 ; A data extracted from Fig. 2.1 <i>advantage from Fig. 2.2 (pH) – activity in alkaline conditions</i> 3 A22, greatest activity / most effective / AW, pH 7.5 – 8.0 or (at least 60%) activity between pH 7.5 – 9.0 ; A range of pH 6.0 – 9.0 but R if stated pH 6.0–7.0 is alkaline or K12, active between pH 7.5 – 8.0 / 8.5 or optimum activity at pH 8.0 or data for (good) activity at stated pH values from Fig. 2.2 for either A22 or K12 ; <i>disadvantage from Fig. 2.2 (pH)</i> 4 use of Fig. 2.3 to show a decrease in activity at higher pH values ;	3

Answer for Question 18 (9700_w23_22_2)

Question	Answer	Marks
2(e)	5 any wash feature in context of mp 1–4 ; e.g. have (some) activity at low temperatures so, more economic /less energy used (to heat water) A ora active at high temperatures but, more costly / needs (more) energy can wash at high(er) temperature so, can sanitise clothes / can kill insect pests / can kill pathogens / shorter time to remove stains comparison of K12 and A22 for washes e.g. K12 more, thermostable / stable in (washes at) higher temperatures K12 has higher optimum temperature so more, costly / energy used K12 only useful at lower alkaline pH A22 has wide(r) working range of pH A22 more tolerant to / stable at, higher pH	

Answer for Question 19 (9700_w23_22_3)

Question	Answer	Marks
3(a)	<u>aorta</u> / dorsal aorta ; <i>correct spelling needed</i>	1
3(b)(i)	any one from: <i>context is using gaps for movement between, hepatocyte / tissue fluid, and, blood / sinusoid</i> I ref. to red blood cells I shorter diffusion, distance / pathway higher rate of / easier for / AW, exchange / movement / AW, of substances ; A named substances / nutrients substances do not have to cross, a cell layer / into and out of endothelial cells ; larger molecules / plasma proteins, can pass through ; Kupffer cells can pass through (into tissue fluid) ; AW A ref. to other phagocytic cells R Kupffer cells can diffuse through R if stated as entering hepatocytes	1

Answer for Question 19 (9700_w23_22_3)

Question	Answer	Marks
3(b)(ii)	<i>max 3 if described as phagocytosis of a pathogen rather than a red blood cell</i> <i>allow rbc for red blood cell</i> <i>any four from:</i> 1 endocytosis / phagocytosis ; 2 described ; e.g. red blood cell, engulfed / enveloped pseudopodia surround red blood cell <i>max three from</i> 3 forms (phagocytic) vacuole / (phagocytic) vesicle / phagosome ; 4 lysosome fuses (with phagosome) ; AW merges / joins to / combines with I attaches / binds to 5 (lysosome contains) hydrolytic / digestive, enzymes ; A hydrolases / named examples 6 digestion to produce haem and globin ; A amino acids for globin 7 AVP ; e.g. suggestion of, detection / recognition, of red blood cell	4

Answer for Question 19 (9700_w23_22_3)

Question	Answer	Marks
3(c)(i)	any three from: I Golgi body / lysosome / vesicle <i>mp1 and mp2 complete term needed either in the text or labelled</i> 1 <u>smooth endoplasmic reticulum</u> labelled on Fig. 3.2 and detail ; e.g. for, lipid / triglyceride / cholesterol, synthesis tubular appearance / no ribosomes 2 <u>rough endoplasmic reticulum</u> labelled on Fig. 3.2 and detail ; e.g. for protein, synthesis / AW A for enzyme synthesis flattened (sac) appearance ribosomes A ribosome(s) labelled <u>and</u> for (plasma) protein synthesis 3 mitochondrion labelled on Fig. 3.2 <u>and</u> detail ; e.g. many mitochondria for (aerobic) respiration produce ATP / provide energy, (for hepatocyte reactions) R generate / make, energy double membrane / presence of cristae <i>allow if one mitochondrion is correctly labelled and one of the 'circular' mitochondria has a different label e.g lysosome</i> 4 presence of glycogen granule(s) as, energy / glucose, store ; A releases / provides, glucose 5 presence of lipid droplet(s), as energy store ; A provides fatty acids A provides components for cholesterol synthesis <i>penalise once (from mp1, 2, or 3) if diagram not labelled but structures named correctly and correct detail given</i>	

Answer for Question 19 (9700_w23_22_3)

Question	Answer	Marks
3(c)(ii)	any one from: I ref. to staining or size mitochondrion, bound by / has, double membrane / two membranes ; I peroxisome has (only) one membrane peroxisome no cristae / mitochondrion has cristae ; R cisternae peroxisome spherical shape <u>and</u> mitochondria, different shapes / AW ; I if only peroxisome shape stated A circular for spherical A description e.g. 'sausage' shape	1
3(c)(iii)	any two from: mitochondrion (ora for peroxisomes) has, DNA / genes (coding for enzymes) ; R linear DNA A genetic, material / information, qualified with, transcription / ref. to mRNA / coding for enzymes (70S) ribosomes (site of enzyme synthesis) ; R 80S ribosomes has the enzymes for, transcription / translation, (to synthesise enzymes) ; can produce ATP (for enzyme synthesis) ; R produce energy I has ATP AVP ; ; other suggestions e.g. has (chaperone) proteins involved in, folding / formation of tertiary structure ATP cannot enter peroxisome to provide energy source peroxisome has enzymes that cause degradation of, one / or more, substance(s) involved in protein synthesis	2

Answer for Question 19 (9700_w23_22_3)

Question	Answer	Marks
3(c)(iv)	any two from: (peroxisome) membrane bound, so rest of cell protected (from hydrogen peroxide) ; A hydrogen peroxide can have toxic effects on (rest of) cell / AW (peroxisome) acts as a compartment / specific area / contained, for, more efficient breakdown of hydrogen peroxide / control of reactions ; high concentration of enzyme in one location ; A more enzyme-substrate complexes can form provides, optimum / AW, conditions, for (other peroxisome) reactions ; production of oxygen as by-product, so useful for, peroxisome reactions requiring oxygen / mitochondrial function / aerobic respiration ; AVP ; e.g. isolates (peroxisomes) enzymes from rest of cell	2

Answer for Question 20 (9700_w23_23_5)

Question	Answer	Marks
5(a)(i)	<i>assimilates are sucrose, amino acids, (named) monosaccharides or other named disaccharide, (named) hormones, accept (named correct) mineral ions</i> <i>root as source</i> <i>idea that root provides (named) assimilate(s) for other parts of the plant ;</i> R if starch is included <i>root as sink</i> <i>root is for storage / root is a storage organ ;</i> A root receives (named) assimilates to, store / grow <i>ref. to bidirectional transport in phloem ;</i> <i>direction of movement changes with demands of plant for (named) assimilates ;</i>	2
5(a)(ii)	sucrose <u>and</u> amino acids ; A other named monosaccharides or disaccharide, (named) hormones, (one named correct) mineral ion(s) / organic acid(s) / sugar alcohol(s) / protein(s) / RNA / AW	1

Question	Answer	Marks
5(b)	<i>any four from:</i> 1 (assimilates) diffuse / enter / AW, into (phloem) sieve, tube / element, from companion cells / via <u>plasmodesmata</u> ; 2 water potential in sieve tubes (in source), decreases / is lower ; R 'lowers water potential gradient' 3 water enters (from surrounding tissues), by osmosis / down water potential gradient ; 4 hydrostatic pressure builds up ; A hydrostatic pressure difference created / <i>ref. to hydrostatic pressure gradient</i> 5 <u>mass flow</u> ; 6 unloading at, (named) sink, decreases / lowers, hydrostatic pressure ; 7 description of unloading as assimilates moving out of sieve tubes and water following ; I activity within companion cell	4

Answer for Question 20 (9700_w23_23_5)

Question	Answer	Marks
5(c)	any three from: 1 TMV maximum accumulation is delayed in V1 and V2 / AW ; 2 <i>data to support mp1:</i> V1 does not start to increase, until day 9 / steeply until day 16 or V2 does not start to increase, until day 22 / steeply until day 24 ; 3 rate at which accumulation increases is slower than the control ; ora <i>I ref. to time</i> <i>A ref. to steepness of accumulation in V1 and V2 compared with C</i> 4 V1 and V2 (and C) reach maximum accumulation / AW ; 5 low quantities of PME do not decrease maximum TMV accumulation or normal PME quantity not required to reach maximum TMV accumulation ; 6 AVP ; for any other valid comparison, e.g. all are slow to start and then very quick to reach 100% all have the same, pattern / trend A correct data: C took 8 days, V1 took 25 days, V2 took 36 days (from infection) to reach maximum	3

Answer for Question 21 (9700_m22_22_1)

Question	Answer	Marks
1(a)	<i>assume in context of transmission electron micrograph unless otherwise stated</i> any one from: <i>idea that can see internal structures ;</i> <i>cannot see surface contours / AW ;</i> A not 3-D appearance AVP ; e.g. ref. to small(er) depth of field ;	1
1(b)	any two from: (flattened) sacs have layered appearance / no connection between membranes / AW / ora ; not, connected to / contiguous with / continuous with, (outer membrane of) nuclear envelope / ora ; swellings at end of sacs (for vesicle formation) / vesicles at ends of sacs ; no ribosomes / ora ;	2
1(c)	actual diameter = image length / magnification ; <i>at 11 mm for X–Y:</i> 234 nm ; A 213 nm (for 10 mm) A 255 nm (for 12 mm) A 223 nm (for 10.5 mm) A 245 nm (for 11.5 mm)	2

Answer for Question 21 (9700_m22_22_1)

Question	Answer	Marks
1(d)(i)	1 glycocalyx 1 glyco / carbohydrate chains A points from labelled diagram 1 phospholipid <u>bilayer</u> ; <i>plus any two from:</i> 2 fatty acid core / fatty acid tails orientated inwards ; 3 protein ; 4 further detail of proteins ; e.g. integral and peripheral / AW scattered (in phospholipid bilayer) 5 cholesterol ;	3
1(d)(ii)	<i>any one relevant suggestion:</i> reduced gaps between membrane molecules ; higher proportion of phospholipids with saturated fatty acids / ora ; fewer unsaturated fatty acids so, fewer 'kinks' in tails / closer packing ; higher proportion of cholesterol molecules ; fewer, channel / carrier / transport, proteins ; smaller diameter of channels in non-specific channel proteins ; fewer types of (specific), transport / carrier, proteins ; AVP ; e.g. fewer, aquaporins / channels for water	1

Answer for Question 22 (9700_s22_21_6)

Question	Answer	Marks												
6(a)	one mark each correct row <table> <tr> <th>feature</th><th>mRNA</th><th>DNA</th></tr> <tr> <td>names of four bases</td><td><u>adenine</u>, <u>cytosine</u>, <u>guanine</u>, <u>uracil</u></td><td><u>adenine</u>, <u>cytosine</u>, <u>guanine</u>, <u>thymine</u> ;</td></tr> <tr> <td>name of pentose sugar present</td><td>ribose</td><td>deoxyribose ;</td></tr> <tr> <td>number of strands</td><td>1 ; 1 single</td><td>2 ; 1 double</td></tr> </table>	feature	mRNA	DNA	names of four bases	<u>adenine</u> , <u>cytosine</u> , <u>guanine</u> , <u>uracil</u>	<u>adenine</u> , <u>cytosine</u> , <u>guanine</u> , <u>thymine</u> ;	name of pentose sugar present	ribose	deoxyribose ;	number of strands	1 ; 1 single	2 ; 1 double	3
feature	mRNA	DNA												
names of four bases	<u>adenine</u> , <u>cytosine</u> , <u>guanine</u> , <u>uracil</u>	<u>adenine</u> , <u>cytosine</u> , <u>guanine</u> , <u>thymine</u> ;												
name of pentose sugar present	ribose	deoxyribose ;												
number of strands	1 ; 1 single	2 ; 1 double												
6(b)(i)	transcription ;	1												
6(b)(ii)	<i>can award either mp1 with mp2 ,or mp3 with mp4</i> 1 removal of introns (from primary transcript / RNA) ; 2 exons joined together ; or 3 splicing ; 4 of, primary transcript / RNA ;	2												

Answer for Question 22 (9700_s22_21_6)

Question	Answer	Marks
6(c)(i)	any four from: 1 <i>ref. to</i> amino acid activation / charging amino acids before attachment to tRNA / AW ; A aminoacylation 2 tRNA attached to, specific amino acid / glycine ; R 'picks up' 3 <i>idea that</i> anticodon / CCG, identifies specific amino acid ; 4 tRNA transports / AW, amino acid to ribosome ; 5 <i>ref. to</i> (tRNA) entering the A (aminoacyl) site in ribosome ; 6 tRNA, anticodon / CCG, binds to mRNA, codon / GGC ; A correct <i>ref. to</i>, complementary pairing / base pairing / H bond formation <i>as AW for binding</i> 7 (specific) amino acid / glycine, in correct position in the polypeptide chain / AW ; A helps to form / AW, primary structure of cotransporter protein 8 AVP ; e.g. tRNA, recycled / reused forms aminoacyl tRNA / amino acid-tRNA complex tRNA-ligase / aminoacyl-tRNA synthetase	4
6(c)(ii)	any three from: 1 movement of sucrose with, protons / H⁺ ions, into companion cells ; A correct <i>ref. to</i> (other named) assimilates 2 (sucrose moved) from, apoplast / cell wall / mesophyll cell ; 3 sucrose moves against its concentration gradient (into companion cell) ; 4 (needs cotransporter protein because) sucrose is polar so cannot pass through membrane ; 5 maintain concentration gradient for sucrose between companion cell and sieve tube (element) ;	3

Answer for Question 23 (9700_s22_22_6)

Question	Answer	Marks
6(a)	any three from: at (phloem) source, mineral ion entry (with water), from xylem / through plasmodesmata from companion cells ; dissolved in water / as solutes in water / in solution / in sap solution ; <i>in context of entry from xylem or within phloem sap</i> (transport) as part of mass flow ; <i>must be in context of phloem</i> flow down a pressure gradient / AW ; R differences in pressure gradient R from high pressure gradient to low pressure gradient AVP ; e.g. suggestion that mineral ions are needed for transport of some assimilates (e.g. complexed with) <i>idea of reallocation of resources / arrive at (phloem) source and are moved to other parts, for use / when needed ;</i>	3
6(b)	sieve, plates / pores ; A perforated end plates / end plates with pores I plasmodesmata periphery / edge / AW ; companion ; A transfer	3

Answer for Question 24 (9700_s22_22_4)

Question	Answer	Marks
4(a)	R if choice given and one is incorrect carbonic acid ; hydrogencarbonate (ions) ; A bicarbonate (ions)	2
4(b)	<i>any one from:</i> similar / same, active site ; have the same catalytic amino acids ; similar / same, tertiary structure ; A same quaternary structure	1

Answer for Question 24 (9700_s22_22_4)

Question	Answer	Marks																		
4(c)	allow pre-RNA for primary transcript either exon or intron statement required for mp2 to 7, one mark each row any three from: <table><tr><th>exons</th><th>introns</th></tr><tr><td colspan="2">1 both, are (nucleotide sequences that are) transcribed / form part of the primary transcript ;</td></tr><tr><td>2 (DNA/RNA) <u>coding</u> (sequences) R coding genes I exons have the genetic code</td><td>(DNA/RNA) <u>non-coding</u> (sequences) R non-coding genes</td></tr><tr><td>3 (RNA exons) needed / involved / AW, in translation or for formation of, polypeptides / proteins / carbonic anhydrase</td><td>not involved in translation / AW</td></tr><tr><td colspan="2">if mps 2 and 3 not gained 'exons code for proteins' or ora 1 mark</td></tr><tr><td>4 not removed, from primary transcript / from RNA / during gene splicing / during RNA splicing</td><td>removed, from primary transcript / from RNA /during gene splicing / during RNA splicing</td></tr><tr><td>5 (join to) form mRNA / contain mRNA codons A remain in mRNA</td><td>not part of mRNA / in primary transcript only</td></tr><tr><td>6 not involved in regulating activity of genes / AW</td><td>may have regulatory roles A other suggestions for role</td></tr><tr><td>7 AVP e.g. (as part of mRNA) leave the nucleus / go to cytoplasm / go to ribosomes</td><td>AVP e.g. remain in nucleus</td></tr></table> if <u>all</u> are differences and <u>all</u> statements are reversed (i.e. introns for exons and vice versa) max 2 marks	exons	introns	1 both, are (nucleotide sequences that are) transcribed / form part of the primary transcript ;		2 (DNA/RNA) <u>coding</u> (sequences) R coding genes I exons have the genetic code	(DNA/RNA) <u>non-coding</u> (sequences) R non-coding genes	3 (RNA exons) needed / involved / AW, in translation or for formation of, polypeptides / proteins / carbonic anhydrase	not involved in translation / AW	if mps 2 and 3 not gained 'exons code for proteins' or ora 1 mark		4 not removed, from primary transcript / from RNA / during gene splicing / during RNA splicing	removed, from primary transcript / from RNA /during gene splicing / during RNA splicing	5 (join to) form mRNA / contain mRNA codons A remain in mRNA	not part of mRNA / in primary transcript only	6 not involved in regulating activity of genes / AW	may have regulatory roles A other suggestions for role	7 AVP e.g. (as part of mRNA) leave the nucleus / go to cytoplasm / go to ribosomes	AVP e.g. remain in nucleus	3
exons	introns																			
1 both, are (nucleotide sequences that are) transcribed / form part of the primary transcript ;																				
2 (DNA/RNA) <u>coding</u> (sequences) R coding genes I exons have the genetic code	(DNA/RNA) <u>non-coding</u> (sequences) R non-coding genes																			
3 (RNA exons) needed / involved / AW, in translation or for formation of, polypeptides / proteins / carbonic anhydrase	not involved in translation / AW																			
if mps 2 and 3 not gained 'exons code for proteins' or ora 1 mark																				
4 not removed, from primary transcript / from RNA / during gene splicing / during RNA splicing	removed, from primary transcript / from RNA /during gene splicing / during RNA splicing																			
5 (join to) form mRNA / contain mRNA codons A remain in mRNA	not part of mRNA / in primary transcript only																			
6 not involved in regulating activity of genes / AW	may have regulatory roles A other suggestions for role																			
7 AVP e.g. (as part of mRNA) leave the nucleus / go to cytoplasm / go to ribosomes	AVP e.g. remain in nucleus																			

Answer for Question 24 (9700_s22_22_4)

Question	Answer	Marks						
4(d)	<i>allow Hb or hb or Hgb for haemoglobin</i> <i>two marks for points in left column or two marks for points in right column</i> <table><tr><td>cytoplasm / cytosol ;</td><td>(bound to) cell surface membrane ;</td></tr><tr><td>close to haemoglobin (for H⁺ uptake) R in / on / with, hb or <i>idea of being dispersed within cell because haemoglobin is distributed throughout ;</i></td><td>close to, anion exchanger / transport protein, for (easy) exit of hydrogen carbonate (ions) ;</td></tr><tr><td>quick for hydrogen carbonate (ions) to be transported out of cell / AW or H⁺ (from dissociation) binds rapidly to haemoglobin or cytoplasm provides water for reaction to form carbonic acid ;</td><td>able to, hydrate / react with, carbon dioxide as it enters cell ;</td></tr></table> <i>if stated cytoplasm <u>and</u> cell surface membrane, one mark</i> <i>reason can be taken from either column if correctly linked, one mark</i>	cytoplasm / cytosol ;	(bound to) cell surface membrane ;	close to haemoglobin (for H ⁺ uptake) R in / on / with, hb or <i>idea of being dispersed within cell because haemoglobin is distributed throughout ;</i>	close to, anion exchanger / transport protein, for (easy) exit of hydrogen carbonate (ions) ;	quick for hydrogen carbonate (ions) to be transported out of cell / AW or H ⁺ (from dissociation) binds rapidly to haemoglobin or cytoplasm provides water for reaction to form carbonic acid ;	able to, hydrate / react with, carbon dioxide as it enters cell ;	2
cytoplasm / cytosol ;	(bound to) cell surface membrane ;							
close to haemoglobin (for H ⁺ uptake) R in / on / with, hb or <i>idea of being dispersed within cell because haemoglobin is distributed throughout ;</i>	close to, anion exchanger / transport protein, for (easy) exit of hydrogen carbonate (ions) ;							
quick for hydrogen carbonate (ions) to be transported out of cell / AW or H ⁺ (from dissociation) binds rapidly to haemoglobin or cytoplasm provides water for reaction to form carbonic acid ;	able to, hydrate / react with, carbon dioxide as it enters cell ;							
4(e)	exocytosis ;	1						
4(f)	<i>any three from:</i> 1 acetazolamide / inhibitor, binds / attaches / AW, to, allosteric site / site other than active site ; R alternative active site 2 (which) changes, shape / tertiary structure / 3-D structure, of active site ; A active site distorted I protein structure <i>allow ecf for mp3 and 4 if competitive described (to max 2)</i> 3 substrate(s) / CO₂ / HCO₃⁻, cannot, enter / bind to / fit in / AW, active site ; A active site no longer complementary to, substrate / AW A enzyme substrate / ES, complexes cannot form A ESCs cannot form I 'substrate / CO₂ / HCO₃⁻ / 'cannot bind to enzyme' <i>without a link to active site</i> 4 product, not formed / released ; A named product 5 <i>ref. to acetazolamide / inhibitor, leaves, allosteric site / enzyme ;</i> I reversibly binds	3						

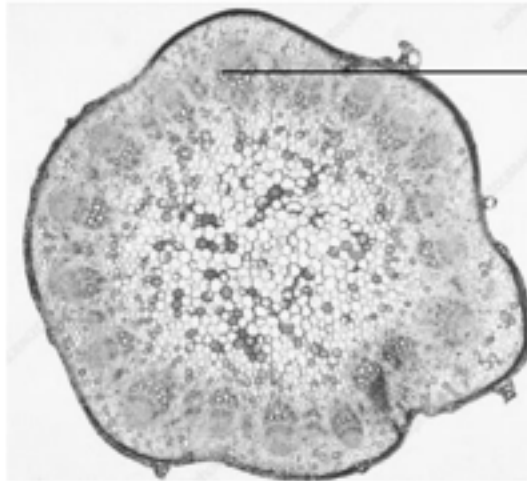
Answer for Question 25 (9700_s22_23_3)

Question	Answer	Marks
3(a)	any three from: decreases / reduces, transpiration ; A lower transpiration rate <i>accept in the correct context once only</i> <i>counts towards max two</i> ! evaporation <i>max two for cuticle</i> thick (waxy) cuticle ; increased waterproof layer ; increased (diffusion) distance for <u>water vapour</u> / less <u>water vapour</u> lost ; <i>in context of cuticular transpiration</i> <i>max two for stoma</i> sunken stoma ; A stoma in depression / AW moist / humid, air collects in area near to external environment ; AW decreases water potential gradient ; <i>in context of between sub-stomatal air space or area above stoma and external environment</i> <i>alternative acceptable statement for the transpiration mark</i> reduces <u>diffusion</u> of <u>water vapour</u> (out) via the stoma ;	3
3(b)(i)	any three from: (many) mitotic cell cycles / mitoses ; AW <i>ref. to division of (meri)stem cell also produces more (meri)stem cells ;</i> formation of rootlets by mitosis is, growth / increase in number of cells ; <i>idea of producing large number of cells</i> R cell growth differentiation / specialisation ; <i>in context of the new cells formed by stem cell division</i>	3

Answer for Question 25 (9700_s22_23_3)

Question	Answer	Marks
3(b)(ii)	<i>any three from:</i> active transport occurring ; (pumped / moved, out) against the(ir) concentration gradient ; (move out through), carrier / pump, protein ; R channel protein using, ATP / energy ; A have ATPase activity AVP ; e.g. membrane impermeable to entry of anions suggestion that move out by exocytosis <i>allow ATP mp if also stated;</i>	3
3(b)(iii)	<i>any two from:</i> increased surface area ; (because, many / more) root hairs / root hair cells ; increase in, carrier proteins / channel proteins (for ion uptake) ; A transport proteins / aquaporins (for water) R channel proteins AVP ; increase in water uptake osmotically to follow ion uptake / AW ;	2

Answer for Question 26 (9700_w22_21_5)

Question	Answer	Marks						
5(a)	one mark for named pathways ; one mark for outline of apoplastic pathway ; <table><tr><th>name of pathway</th><th>outline of pathway</th></tr><tr><td>symplast / symplastic</td><td>movement of water from cell to cell via plasmodesmata</td></tr><tr><td>apoplast / apoplastic</td><td>movement of water via, cell walls / intercellular spaces</td></tr></table>	name of pathway	outline of pathway	symplast / symplastic	movement of water from cell to cell via plasmodesmata	apoplast / apoplastic	movement of water via, cell walls / intercellular spaces	2
name of pathway	outline of pathway							
symplast / symplastic	movement of water from cell to cell via plasmodesmata							
apoplast / apoplastic	movement of water via, cell walls / intercellular spaces							
5(b)	label line labelled T to any area of xylem tissue ; e.g. 	1						

Answer for Question 26 (9700_w22_21_5)

Question	Answer	Marks
5(c)(i)	lysosome ;	1
5(c)(i)i	any three from: increased permeability to water ; increased, aquaporins / protein channels (in the tonoplast) ; water potential in vacuole is lower than that of cytoplasm ; A more ions in vacuole lower water potential more water enters (vacuole) by osmosis ; vacuole increases, in volume / pressure (until it bursts) ; AVP ; e.g. fewer transport proteins for exit of ions	3
5(c)(iii)	<i>allow two suggestions or a suggestion with further detail, for two marks</i> active site becomes complementary to substrate ; (because) bonds altered between R groups of amino acids ; A hydrogen / ionic, bonds removal of a portion that blocks the active site ; AW substrate can enter active site ; <i>idea of cofactor / AW, associates with the enzyme ;</i> enzymes becomes functional ; sets off an enzyme cascade / ref. cell signalling ; AVP ;	2

Answer for Question 26 (9700_w22_21_5)

Question	Answer	Marks
5(d)(i)	any two from: caused by a pathogen ; <i>idea that</i> it is transmissible / passed from infected plant to uninfected plant ; results in harm being caused / AW ;	2
5(d)(ii)	protocist ; <u>Plasmodium falciparum</u> / <u>Plasmodium malariae</u> / <u>Plasmodium ovale</u> / <u>Plasmodium vivax</u> ; A <i>Plasmodium knowlesi</i>	2

Answer for Question 27 (9700_w22_22_6)

Question	Answer	Marks
6(a)	any two from: 1 (water is a) solvent, for, assimilates / minerals / ions / polar molecules A hydrophilic A named or substances, in xylem and phloem sap / that are transported, dissolve in water / are in solution ; A (water is a) good / universal / versatile, solvent 2 feature for xylem ; e.g. water can move up, as part of transpiration stream ref. cohesion between water molecules adhesion between water and, cellulose / wall of xylem / xylem lining hydrogen bonds for cohesion and adhesion I for cohesion-tension 3 feature for phloem ; e.g. water used to build up, hydrostatic pressure / pressure gradient / pressure differences, for, mass flow / translocation / transport / AW <i>if not gained for mp2 allow similar ref. to cohesion / adhesion, for, phloem sap movement / transport</i> 4 AVP ; e.g. (xylem sap) water moving down a water potential gradient contributes to transpiration stream	2
6(b)	A phloem sieve tube element ; B companion cell ; C companion cell ;	3

Answer for Question 28 (9700_w22_22_4)

Question	Answer	Marks
4(a)	any two from: presence of mucus can, hinder / prevent / AW, gas exchange / entry of air (to alveoli) / airflow (to alveoli) ; A named gases detail ; e.g. (lumens of) airways / respiratory bronchioles, are narrow or airways / respiratory bronchioles, are close to alveoli <i>suggestion that <u>respiratory</u> bronchioles have, few / no, cilia present so difficult to move mucus / AW ;</i> R bronchioles do not have cilia as a general statement mucus increases distance for diffusion of (respiratory) gases / oxygen / carbon dioxide ; R if direction of diffusion of gas is incorrect increased risk of infection from trapped pathogens if mucus present ; AW	2
4(b)(i)	any three from: (bronchioles) have columnar, epithelium / cells ; A columnar and cuboidal, epithelium / cells (bronchioles) have ciliated, epithelium / (epithelial) cells ; A cilia (are present) ora (alveoli) have squamous, epithelium / cells ; I endothelium / endothelial cells detail ; e.g. (bronchiole epithelial cells) longer / wider / thicker R if, mucus makes it thicker / stated as more than one layer or (alveolar cells) flatter / thinner <i>allow ideas if stated as epithelium (rather than cells)</i> AVP ; e.g. ref. to alveolar type II cells / cells secreting surfactant	3

Answer for Question 28 (9700_w22_22_4)

Question	Answer	Marks
4(b)(ii)	<u>smooth muscle</u> ; <i>plus any two from:</i> <i>max 1 for function if stretch and recoil or vasoconstriction / vasodilation stated</i> (muscle) <u>contracts</u> / <u>contraction</u> (and relaxation of bronchiole, lining / wall) ; R contraction of, bronchiole / lungs / other airways change / decrease, diameter of, bronchiole / lumen / airway ; A adjust size of airway A constriction of, bronchiole / airway control of air flow (to and from alveoli) / AW ; e.g. control volume of air, entering / leaving, alveoli <i>allow ecf max two marks if incorrectly stated as elastic fibres</i> stretch / expand, during inhalation ; A stretch and recoil prevents, overstretching / bursting, during inhalation ; recoils to help move air out during exhalation; <i>allow ecf to max one mark if incorrectly stated as cartilage</i> prevent collapse of, bronchiole / airway ; provides support / keeps airway open ;	3

Answer for Question 29 (9700_w22_23_3)

Question	Answer	Marks
3(a)	any four from: 1 ref to, difference in water potential / water potential gradient ; 2 (continuous) columns of water (in xylem of, tree trunk / stem) ; I stream 3 transpiration pull / cohesion-tension ; 4 hydrogen bonding / cohesion, between water molecules ; 5 hydrogen bonding / adhesion, between water and, the lining of the xylem / cellulose (in walls of xylem) / hydrophilic parts of lignin ;	4
3(b)	any four from: 1 cavitation (only) occurs when, light is available / PAR is available / the trees photosynthesise ; 2 water movement / transpiration, (only) occurs when, light is available / PAR is available / the trees photosynthesise ; 3 no clear relationship between values for, light energy / PAR, and cavitation rate ; 4 peaks of cavitation does not coincide with peaks for, PAR / wind speed ; A peaks occur around the time of peak in, PAR / wind speed 5 no cavitation when the wind speed is below 1.25 m s^{-1} ; 6 PAR affects, cavitation (rate) / water movement / transpiration (rate), <u>more than</u> wind speed ;	3

Answer for Question 30 (9700_w22_23_5)

Question	Answer	Marks
5(a)(i)	any two from: 1 idea of the cells have the, same receptor / specific receptor (for LL-37) ; 2 on cell (surface) membrane / inside cell ; 3 (shape of) receptor is complementary to (shape of), cathelicidin / signalling compound / ligand ; I antigen R active site	2
5(a)(ii)	any two from: 1 thin cells ; A (they are) squamous R 'made of squamous epithelial cells' I flat / flattened R 'they have thin (cell) walls' 2 smooth / AW, (luminal) surface ; 3 cells are wider in region of the nucleus ; A nucleus bulges from cell 4 ref to, endothelial pores / fenestrations / pores between cells / gaps between cells ;	2
5(b)(i)	(TTC to TAC) change from phe to tyr (at position 5) ; I 'tyr' unqualified	1

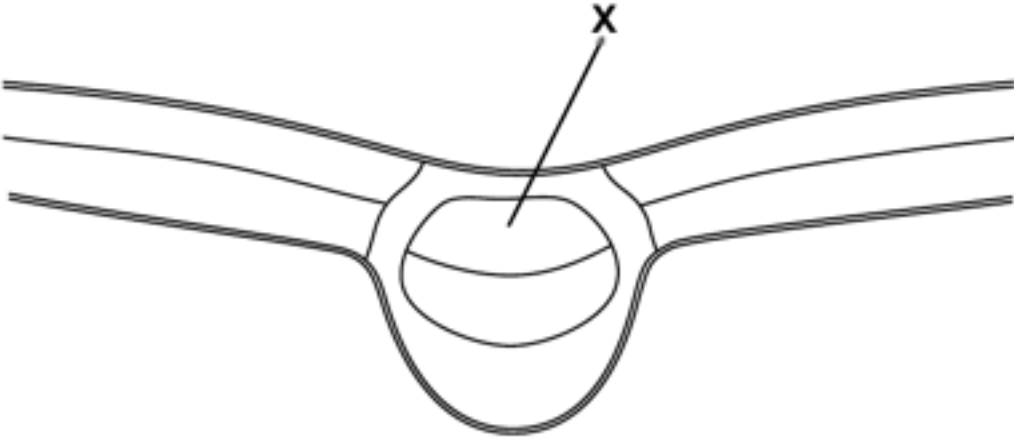
Answer for Question 30 (9700_w22_23_5)

Question	Answer	Marks
5(b)(ii)	<i>allow two marks for</i> new sequence is leu arg val ile ser ser gly asp leu ;; <i>or allow any two from:</i> I refs to frameshift 1 sequence after, first amino acid / first leu, is different ; R 'after position 2' A 'from position 2 onwards' 2 any example ; e.g. amino acid (at position 2) is arg 3 shortened polypeptide / early chain termination ;	2
5(b)(iii)	<i>any two from:</i> peptide is 3 amino acids in length / shortened polypeptide ; stop codon in position 4 ; (third) amino acid is <u>still</u>, gly(cine) / the same ;	2
5(c)	(genetic code) is the, same / similar, in all organisms AW or <i>idea that</i> each triplet codes for the same amino acid in all living organisms ;	1
5(d)	<i>any two from:</i> 1 (most) amino acids have more than one, triplet / codon ; 2 any correct example(s) from Table 5.2 ; <i>if award this then award mp1 as well</i> 3 genetic code is, degenerate / redundant ; R degenerative / degenerated 4 <i>idea that</i> 64 / 61, possible codons for 20 different amino acids ;	2

Answer for Question 31 (9700_m21_22_5)

Question	Answer	Marks
5(a)(i)	<i>if one phase not attempted, max 3</i> any four from: <i>S phase:</i> 1 DNA replication ; <i>explanation:</i> 2 produces two genetically identical, DNA molecules (one for each daughter cell ; A (sister) chromatids for DNA molecules A description of semi-conservative replication <i>metaphase:</i> 3 chromosomes / pairs of sister chromatids align / orientate at (spindle) equator ; A metaphase plate for equator ; <i>explanation:</i> 4 chromosomes orientated so that sister chromatids will be shared out to daughter cells / AW ; <i>anaphase:</i> 5 centromere splits / spindle fibres shorten / AW ; <i>explanation:</i> 6 so that daughter chromosomes / sister chromatids / identical chromatids, move to opposite poles ; 7 AVP ; e.g. ref. to checkpoints and ref. to error, detection / repair ref. to kinetochore / centromere, and attachment to spindle fibres at, metaphase / anaphase	4
5(a)(ii)	unequal sharing out of, cytoplasm / organelles / named organelles, (at cytokinesis) ; A uneven sizes	1

Answer for Question 31 (9700_m21_22_5)

Question	Answer	Marks
5(b)(i)	<i>max 3 structural changes:</i> 1 ref. to function of xylem ; e.g. transport of water and (dissolved) mineral ions transport of water from roots to other parts of the plant <i>in context of leaf xylem</i> receipt of water from roots 2 end walls broken down ; 3 (so) tubes form (to transport water long distances) ; 4 (so), uninterrupted / unhindered / continuous, flow ; 5 ref lignification ; 6 lignin strengthens vessels ; 7 ref. to cell death ; 8 cells, become hollow / lose contents / lose cytoplasm or organelles / named organelles, digested / broken down ; 9 greater quantity of water can flow (per unit, time / length) ; 10 AVP ; e.g. tonoplast / vacuole, breakdown / rupture, to release hydrolytic enzymes ref. to xylem patterning during growth ref, to pits	4
5(b)(ii)	label line to xylem, labelled X ; 	1
6(a)	<i>Vibrio cholerae</i> ;	1

Answer for Question 32 (9700_s21_22_2)

Question	Answer	Marks
2(a)	<i>any three from</i> <i>decrease in sugar</i> 1 <i>idea that changing / transition, from sink to source</i> e.g. leaf becomes the source leaf no longer the sink sugars are (now) being moved away from leaf was a growing area, now translocating (sugars) 2 <i>photosynthesis provides enough sugar / (rate of) photosynthesis increases ;</i> A leaf (now) makes enough sugar I makes own food <i>increase in water to max 2</i> 3 <i>increase in size / more cells / increase in (leaf) surface area, (so proportionate increase in water) ;</i> 4 <i>(more cells that need) water to, maintain turgidity / prevent flaccidity / prevent wilting, (because of transpiration) ;</i> 5 <i>increased transpiration / greater number of stomata ;</i> A increased evaporation (greater internal leaf area) 6 <i>water is, a reactant / needed, for photosynthesis ;</i> <i>(in context of increased photosynthesis, more water needed)</i> 7 <i>AVP ; e.g. maturing leaf growth rate slows / mature leaf no growth</i> <i>(more cells, so more) water needed for, cellular reactions / AW</i> e.g. for hydrolysis of starch <i>(more) water needed for, cell elongation / enlarging vacuoles</i>	3

Answer for Question 32 (9700_s21_22_2)

Question	Answer	Marks																				
2(b)	one mark each correct row ;;; column mark can be used <u>instead of</u> row mark (if higher mark achieved) <table><tr><th>feature</th><th>companion cells</th><th>phloem sieve tube element</th><th>xylem vessel element</th></tr><tr><td>cytoplasm</td><td>✓</td><td>✓</td><td>x</td></tr><tr><td>cell surface membrane</td><td>✓</td><td>✓</td><td>x</td></tr><tr><td>lignified cell wall</td><td>x</td><td>x</td><td>✓</td></tr><tr><td>nucleus</td><td>✓</td><td>x</td><td>x</td></tr></table>	feature	companion cells	phloem sieve tube element	xylem vessel element	cytoplasm	✓	✓	x	cell surface membrane	✓	✓	x	lignified cell wall	x	x	✓	nucleus	✓	x	x	4
feature	companion cells	phloem sieve tube element	xylem vessel element																			
cytoplasm	✓	✓	x																			
cell surface membrane	✓	✓	x																			
lignified cell wall	x	x	✓																			
nucleus	✓	x	x																			